SOIL SURVEY OF

Henrico County, Virginia

United States Department of Agriculture
Soil Conservation Service

In cooperation with

Virginia Polytechnic Institute and
State University

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1961-70. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the country in 1970. This survey was made cooperatively by the Soil Conservation Service and the Virginia Polytechnic Institute and State University. It is part of the technical assistance furnished to the James River Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Henrico County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and woodland suitability group of each. It also shows the page where each soil is described and the page for the capability unit in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil description and from the discussions of the capability units and the woodland suitability groups.

Foresters and others can refer to the section "Woodland Uses of the Soils" where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in Henrico County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

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SOIL SURVEY OF HENRICO COUNTY, VIRGINIA

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HENRICO COUNTY is in east-central Virginia. It is bordered on the north by the Chickahominy River, on the east by Charles City County, on the south by the James River and the city of Richmond, and on the west by Goochland County (fig. 1). It has

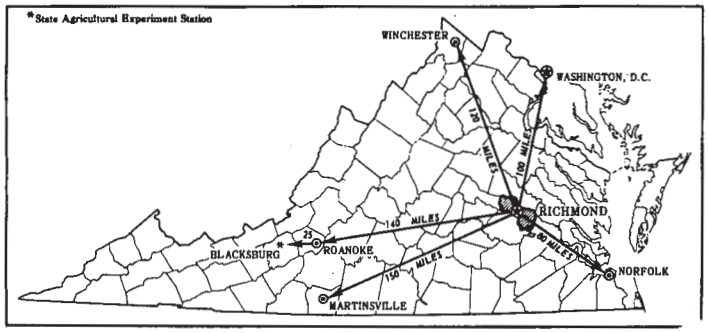

Figure 1.—**Location of Henrico County in Virginia.**

an area of 229 square miles, or 146,560 acres. The population in 1969 was 159,761.

The county is divided by the fall line, with the eastern section on the Atlantic Coastal Plain and the western section on the Piedmont Plateau. The fall line is generally the head of Navigation on the major streams and is where the waters cease to be affected by tidal action.

Although farming has been the main land use, urban expansion from the city of Richmond into the county is rapidly replacing farming with housing, industry, and shopping centers. Most of the farms produce small grains, corn, soybeans, and beef cattle. A few farms raise hogs, sheep, and goats. Poultry and dairy enterprises were important in the past, but few remain active.

About 60 percent of Henrico County is wooded.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Henrico County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* is the category of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils on one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Bourne and Pamunkey, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Pamunkey fine sandy loam, 0 to 2 percent slopes, is one of several phases within the Pamunkey series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the

back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Henrico County: soil complexes and undifferentiated groups. A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Mantachie-Chastrain complex is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and"; such as Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded.

In most areas surveyed there are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey. Some are called land types and are given descriptive names, such as Urban land. Others are named from the higher categories of the soil classification system, more general than the soil series, to indicate soil properties that are important to their use, such as Aquents, loamy, and Fluvaquents.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The General Soil Map at the back of this survey shows, in color, the soil associations in Henrico County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Henrico County are discussed in the following pages.

1. Colfax-Helena-Bourne Association

Deep, somewhat poorly drained and moderately well drained soils; some have a fragipan and some have a clay subsoil; on uplands

This soil association is an area of nearly level to gently rolling uplands. Slopes are dominantly 0 to 6 percent, but range to 15 percent in small areas.

This association makes up about 18 percent of the county. It is about 26 percent Colfax soils, 9 percent Helena soils, 8 percent Bourne soils, 8 percent Pouncey soils, and 49 percent less extensive soils.

Colfax soils are deep, somewhat poorly drained, and nearly level to gently sloping. They are present throughout most areas of the association. These soils are slowly permeable and have a fragipan at a depth of 25 to 40 inches. They have a surface layer of dark-gray, brownish-gray, and grayish-brown fine sandy loam. Above the fragipan the subsoil is yellowish-brown and brownish-gray sandy clay loam. The fragi-

pan is strong-brown, brownish-gray, and white sandy clay loam and sandy loam. Reaction is very strongly acid throughout.

Helena soils are deep, moderately well drained, and gently sloping and sloping. They are present throughout most areas of the association. They are slowly permeable. These soils have a surface layer of grayish-brown fine sandy loam and a clay subsoil that is yellowish brown in the upper part and mixed brownish yellow and strong brown, mottled with gray, in the lower part. Reaction is very strongly acid throughout.

Bourne soils are deep, moderately well drained, and nearly level to gently sloping. They are slowly permeable and have a fragipan at a depth of 18 to 24 inches. These soils have a surface layer of grayish-brown and pale-brown fine sandy loam. The subsoil above the fragipan is yellowish-brown sandy clay loam, and the fragipan is yellowish brown. Reaction is very strongly acid throughout.

Pouncey soils are poorly drained and have a clay subsoil. A layer of dense material similar to sandstone is at a depth of about 28 inches.

Of lesser extent in the association are Abell, Appling, Cecil, Chewacla, Creedmoor, Kinston, Mantachie, Mayodan, Pinkston, and Turbeville soils and the Orthents-Udults-Mine pits complex. Small areas of gently sloping Abell soils are at the heads of drainageways. Gently sloping and sloping Appling, Cecil, Creedmoor, Mayodan, Pinkston, and Turbeville soils are commonly on high areas and that are scattered throughout the association. Chewacla, Kinston, and Mantachie soils are on flood plains of small streams and along drainageways. Areas of Orthents-Udults-Mine pits complex are along Big Tuckahoe Creek and Gayton Road and along the upper reaches of Deep Run Creek. They consist of mine pits and shafts, mine spoil, and the associated disturbed soils that are the result of past coal-mining operations.

The natural drainage pattern is weakly developed in this association, and there are many springs and seeps. Many nearly level and gently sloping areas are excessively wet during winter and early in spring but are droughty late in summer and in fall.

Much of the acreage of the association is wooded, but small areas are cultivated or in pasture. Urban development is expanding in the association, although many of the soils have severe limitations for many urban uses.

2. Appling-Wedowee-State Association

Deep, well drained soils that have a clay, clay loam, or sandy clay loam subsoil; on uplands

This soil association is an area of gently rolling uplands, with steeper slopes near the larger streams. Nearly level to gently sloping areas are scattered throughout the association. Ridge slopes are dominantly 2 to 6 percent, side slopes are 6 to 15 percent, and the steeper slopes near the larger streams range up to 45 percent.

This association makes up about 16 percent of the county. It is about 29 percent Appling soils, 14 percent Wedowee soils, 13 percent State soils, and 44 percent less extensive soils.

Appling soils are deep and well drained, and they are among the steeper soils in the association. They are on ridges and side slopes throughout most of the association. These soils are moderately permeable. They have a surface layer of brown and yellowish-brown fine sandy loam and a subsoil of strong-brown or yellowish-red clay. Reaction is strongly acid to very strongly acid.

Wedowee soils are deep and well drained. They are on ridges and side slopes throughout most of the association. These soils are moderately permeable. They have a surface layer of dark-gray and pale-brown sandy loam and a subsoil of brown and strong-brown clay loam. Reaction is very strongly acid throughout.

State soils are deep, well drained, and gently sloping. They are on ridges and some of the less steep side slopes. These soils are moderately permeable. They have a surface layer of olive-brown fine sandy loam and a subsoil of yellowish-brown and a strong-brown sandy clay loam that changes to clay below a depth of about 60 inches.

Of lesser extent in the association are Abell, Ashlar, Bourne, Cecil, Chewacla, Colfax, Helena, Kempsville, Kinston, Mantachie, Pouncey, Riverview and Turbeville soils. Small areas of gently sloping Abell soils are at the heads of drainageways. Ashlar, Bourne, Cecil, Helena, Kempsville, and Turbeville soils commonly are in positions similar to those of Appling, State, and Wedowee soils. Chewacla, Kinston, Mantachie, and Riverview soils are on small flood plains along drainageways and streams. Small, low-lying areas of nearly level to sloping Pouncey and Colfax soils are present throughout the association.

The natural drainage pattern is well developed in this association. The nearly level to gently sloping areas are often excessively wet during winter and early in spring but are droughty late in summer and in fall.

Most of the acreage of the association is wooded, but small areas are either cultivated or in pasture. General farm crops and beef cattle are produced to a limited extent in the northern part of the association. Urban development is expanding in the association, although the nearly level to gently sloping soils commonly have slight to severe limitations for many urban uses.

3. Kempsville-Atlee-Duplin Association

Deep, well drained and moderately well drained soils that have a dominantly sandy clay loam or clay subsoil; some have a fragipan; on uplands

This soil association is an area of nearly level to gently rolling uplands. Broad, nearly level to gently sloping areas are scattered throughout the association. Ridge slopes are dominantly 0 to 6 percent, and side slopes are 6 to 15 percent.

This association makes up about 21 percent of the county. It is about 32 percent Kempsville soils, 19 percent Atlee soils, 19 percent Duplin soils, 12 percent Carolina soils, and 18 percent less extensive soils .

Kempsville soils are deep and well drained. They are on ridges and side slopes throughout most of the association. These soils are moderately permeable. They have a surface layer of brown fine sandy loam and a subsoil of yellowish-brown sandy clay loam. Reaction is very strongly acid to strongly acid.

Atlee soils are deep, moderately well drained, and nearly level. They are on broad, ridges throughout most of the association. These soils have moderately slow permeability and have a weak fragipan at a depth of 22 to 30 inches. They have a surface layer of dark grayish-brown and yellowish-brown very fine sandy loam and loam. The subsoil is olive-brown clay loam. The weakly developed fragipan is pale-yellow and brownish-yellow clay loam. Reaction is strongly acid to very strongly acid.

Duplin soils are deep and moderately well drained. They are on ridges and side slopes throughout most of the association. These soils have moderately slow permeability. They have a surface layer of yellowish-brown very fine sandy loam and a subsoil that is strong-brown clay loam in the upper part and reddish-yellow, mottled clay in the lower part. Reaction is very strongly acid throughout.

Carolina soils are deep, well-drained soils that have a subsoil of clay loam and clay. They are on the narrower ridges and side slopes of more rolling areas scattered throughout the association.

Of lesser extent in the association are Bertie, Bourne, Chewacla, Faceville, Kinston, Lenoir, Lynchburg, Mantachie, Rumford, Ruston, Sassafras, and Turbeville soils and Fluvaquents and Udorthents. Bourne, Faceville, Rumford, Ruston, Sassafras, and Turbeville soils are in positions similar to those of the Duplin and Kempsville soils. Bertie, Lenoir, and Lynchburg soils are in broad, nearly level areas. Chewacla, Kinston, and Mantachie soils are on small flood plains along drainageways and streams. Fluvaquents are in swampy areas along drainageways and streams. Udorthents are in areas where the soils have been changed or covered over by cut and fill operations.

Gravel pits are areas where sand and gravel is mined for commercial purposes. One of the largest gravel pits in the county is in this association.

The natural drainage pattern is well developed in this association, except in a few small, nearly level areas. These nearly level areas are excessively wet during winter and early in spring.

More than half of the acreage of the association is wooded, but large areas are cultivated or are in pasture, especially in the eastern part of the association. General farm crops and beef cattle are produced. Urban development is expanding, especially in the western part near the city of Richmond. Many of the soils have moderate limitations for many urban uses.

4. Ochrepts and Udults-Norfolk-Caroline Association

Deep, moderately well drained to excessively drained soils that are dominantly sandy clay loam or clay below the surface layer; some are gravelly; on uplands

This soil association is an area of rolling to hilly uplands. Side slopes commonly range from 10 to 25 percent but range to as much as 60 percent in a few areas.

This association makes up about 18 percent of the county. It is about 24 percent Ochrepts and Udults, 19 percent Norfolk soils, 13 percent Caroline soils, and 44 percent less extensive soils.

Ochrepts and Udults are groups of soils that are deep and well drained to excessively drained. They formed in sloping to steep, stratified, Coastal Plain sediments and are on side slopes over most of the association. These soils are moderately rapidly permeable to moderately slowly permeable. Textures commonly are loamy, and some areas are gravelly. Reaction is strongly acid to extremely acid.

Norfolk soils are deep and well drained. They are on the ridges and many of the less steep side slopes throughout the association. These soils are moderately permeable. They have a surface layer of dark grayish-brown and yellowish-brown fine sandy loam and a subsoil of strong-brown sandy clay loam. Reaction is medium acid to very strongly acid.

Caroline soils are deep and well drained. They are on the ridges and many of the less steepside slopes throughout the association. These soils are moderately slowly permeable. They have a surface layer of pale-brown very fine sandy loam and a subsoil of yellowish-brown, strong-brown, and red clay loam and clay. Reaction is very strongly acid throughout.

Of lesser extent in the association are Bourne, Chewacla, Faceville, Kempsville, Kinston, Mantachie, Rumford, Ruston, Sassafras, Tetotum, and Turbeville soils. Bourne, Faceville, Kempsville, Rumford, Ruston, Sassafras, Tetotum, and Turbeville soils are in positions similar to those of the Caroline and Norfolk soils. Chewacla, Kinston, and Mantachie soils are on flood plains along drainageways and small streams.

The natural drainage pattern is well developed in this association. Springs and seeps are common in Ochrepts and Udults along midslopes and bases of slopes.

Most of the acreage of the association is wooded, but small, less sloping areas are either cultivated or in pasture. A number of gravel pits are present in the association. Urban development is expanding in the association, especially in those areas near the city of Richmond, although many of the soils have moderate to severe limitations for many urban uses.

5. Lynchburg-Rains-Coxville Association

Deep, somewhat poorly drained and poorly drained soils that have a dominantly clay loam or clay subsoil; on upland flats

This soil association is an area of nearly level uplands. Slopes dominantly range from 0 to 2 percent.

This association makes up about 4 percent of the county. It is about 57 percent Lynchburg soils, 18 percent Rains soils, 14 percent Coxville soils, and 11 percent less extensive soils.

Lynchburg soils are deep and somewhat poorly drained. They are present throughout most areas of the association. These soils are moderately permeable. They have a surface layer of black and yellowish-

brown very fine sandy loam and a subsoil of olive-brown and gray clay loam. Reaction is extremely acid to very strongly acid.

Rains soils are deep and poorly drained. They are present throughout most areas of the association. These soils are moderately permeable. They have a surface layer of grayish-brown very fine sandy loam and a subsoil of gray clay loam and clay. Reaction is very strongly acid throughout.

Coxville soils are deep and poorly drained. They are present throughout most areas of the association. These soils are moderately slowly permeable. They have a surface layer of very dark gray silt loam and a subsoil of gray clay. Reaction is very strongly acid throughout.

Of lesser extent in the association are Atlee, Bertie, Caroline, Faceville, Lenoir, and Portsmouth soils. Atlee, Bertie, Lenoir, and Portsmouth soils are in positions similar to those of the Coxville, Lynchburg, and Rains soils. Caroline and Faceville soils are on small, higher lying ridges scattered throughout the association.

The natural drainage pattern is poorly developed in this association. Many of the soils are excessively wet during winter and in spring.

Nearly half the acreage of the association is wooded, and small scattered areas are cultivated or in pasture. About half the acreage of the association is in urban development, although many of the soils have severe limitations for many urban uses.

6. Angie-Pamunkey-Lenoir Association

Deep, moderately well drained, well drained or somewhat poorly drained soils that have a dominantly silty clay, sandy clay loam, or clay subsoil; on stream terraces

This soil association is an area of nearly level to gently sloping terraces. Slopes dominantly range from 0 to 6 percent. Scattered steeper areas are present in the association. Slopes in these areas commonly range from 6 to 15 percent but may range to as much as 50 percent.

This association makes up about 21 percent of the county. It is about 16 percent Angie soils, 13 percent Pamunkey soils, 12 percent Lenoir soils, and 59 percent less extensive soils.

Angie soils are deep and moderately well drained. They are present throughout most of the association but are mainly in the area along the James River in southern Henrico County. These soils are slowly permeable. They have a surface layer of pale-brown loam and a subsoil of yellowish-brown silty clay that is mottled with gray. Reaction is strongly acid throughout.

Pamunkey soils are deep and well drained. They are present throughout most of the association but are mainly in the area along the James River in Southern Henrico County. These soils are moderately permeable. They have a surface layer of brown fine sandy loam and a subsoil of brown sandy clay loam. Reaction is slightly acid to strongly acid.

Lenoir soils are deep and somewhat poorly drained. They are present throughout most of the association but are mainly in the area along the James River in the southern part of the County. These soils are slowly permeable. They have a surface layer of pale-brown silt loam and a subsoil of yellowish-brown and gray silty clay loam and clay. Reaction is very strongly acid throughout.

Of lesser extent in the association are Altavista, Buncombe, Chastain, Chewacla, Kalmia, Kinston, Mantachie, Myatt, Riverview, Roanoke, State, Tetotum, and Toccoa soils and Fluvaquents, Hydraquents, and Udorthents. Buncombe, Chastain, Chewacla, Kinston, Mantachie, Riverview, and Toccoa soils are on flood plains along the streams of the association. Altavista, Kalmia, Myatt, Roanoke, State, and Tetotum soils are in positions similar to those of Angie and Pamunkey soils. Kalmia and Myatt soils are mostly along the Chickahominy River. Fluvaquents are swampy areas along drainageways and small streams. Hydraquents are soils covered by tidal waters and are along the lower part of the James River. Udorthents are in areas where the soils have been changed or covered over by cut and fill operations.

The natural drainage pattern is moderately well developed to poorly developed in this association. Many low-lying, nearly level areas are excessively wet in winter and spring. Springs and seeps are present where the association adjoins the uplands. Most of the association is subject to flooding, particularly along the Chickahominy River. Much of the area of this association along the James River does not flood except when the water level is extremely high.

Much of the acreage of the association is wooded, except for the area along the James River in the southern part of the county, which is cultivated or in pasture. Many of the soils have severe limitations for many urban uses.

7. Chewacla-Riverview-Toccoa Association

Deep, somewhat poorly drained and well drained soils that have a dominantly silt loam, fine sandy loam, or very fine sandy loam subsoil; on flood plains

This soil association is an area of nearly level stream bottoms. Slopes dominantly range from 0 to 2 percent.

This association makes up about 2 percent of the county. It is about 51 percent Chewacla soils, 13 percent Riverview soils, 11 percent Toccoa soils, and 25 percent less extensive soils.

Chewacla soils are deep and somewhat poorly drained. They are present throughout most of the association. These soils are moderately permeable. They have a surface layer of dark-brown silt loam and a subsoil of dark-brown silt loam mottled with gray. Reaction is very strongly acid to medium acid.

Riverview soils are deep and well drained. They are present throughout most of the association. These soils are moderately permeable. They have a surface layer of dark-brown and brown silt loam and a subsoil of brown silt loam. Reaction is strongly acid to medium acid.

Toccoa soils are deep and well drained. They are present throughout most of the association. These soils are moderately rapidly permeable. They have a surface layer of dark grayish-brown and dark yellowish brown fine sandy loam and a subsoil of dark reddish-brown very fine sandy loam and fine sandy loam. Reaction is medium acid to strongly acid.

Of lesser extent in the association are Buncombe, Chastain, Kinston, Pamunkey, and Roanoke soils and Fluvaquents. Buncombe, Chastain, Kinston, and Roanoke soils are in positions similar to those of Chewacla, Riverview, and Toccoa soils. Fluvaquents are swampy areas along drainageways and small streams. Pamunkey soils are in small, higher lying areas scattered throughout the association.

The natural drainage pattern is moderately well developed to poorly developed in this association. Many of the soils are excessively wet during winter and in spring. The association is subject to flooding.

Much of the acreage of the association is cultivated or in pasture, but small areas are wooded. Many of the soils have severe limitations for many urban uses.

Descriptions of the Soils

This section describes the soil series and mapping units in Henrico County. Each soil series is described in detail, and then, briefly, each mapping unit in that series, is described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soils unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Hydraquents and Udorthents, for example, do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and woodland suitability group in which the mapping unit has been placed. The page for the description of each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in Table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*6*).[1]

Abell Series

The Abell series consists of deep, well drained to moderately well drained, gently sloping soils that have a loamy subsoil. These soils are in depressions, on foot slopes, and at the heads of drainageways. They formed in material weathered from granite and gneiss that washed from surrounding upland soils. In unlimed areas the subsoil of Abell soils is strongly acid.

In a representative profile the surface layer is dark-brown fine sandy loam 11 inches thick. The subsoil, which extends to a depth of 42 inches, is strong-brown light clay loam in the upper part, yellowish-red clay loam in the middle part, and yellowish-red gravelly clay loam in the lower part. The substratum between depths of 42 and 86 inches is yellowish-brown and white clay loam. Brownish-yellow mottles are in the lower part.

Available water capacity is high in Abell soils. Permeability is moderate in the subsoil. A seasonal high water table is at a depth of 3 to 5 feet for brief periods.

Representative profile of Abell fine sandy loam, 2 to 6 percent slopes, in a field one-fourth mile north of Moreland and the Chesapeake and Ohio Railway and one-fourth mile south of Moreland Road:

Ap—0 to 11 inches, dark-brown (10YR 4/3) fine sandy loam; moderate, medium, granular structure; friable, nonsticky and nonplastic; common fine and medium roots; few medium pores; common rounded pebbles; medium acid; abrupt, smooth boundary.

B21t—11 to 17 inches, strong-brown (7.5YR 5/6) light clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; few medium pores; common rounded pebbles; few thin patchy clay films; strongly acid; clear, smooth boundary.

B22t—17 to 32 inches, yellowish-red (5YR 5/8) clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and plastic; few fine roots; common rounded pebbles; thin patchy clay films; strongly acid; clear, smooth boundary.

IIB23t—32 to 42 inches, yellowish-red (5YR 4/8) gravelly clay loam; few medium, distinct, grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; friable, slightly sticky and plastic; common rounded pebbles; thin patchy clay films; strongly acid; clear, smooth boundary.

IIIC1—42 to 64 inches, yellowish-brown (10YR 5/8) clay loam; common medium, distinct, grayish-brown (10YR 5/2) mottles; massive, firm, slightly sticky and slightly plastic; few semirounded pebbles; strongly acid; clear, smooth boundary.

IIIC2—64 to 86 inches, mottled, white (10YR 8/2) and light-gray (10YR 7/2) clay loam; common medium, distinct, brownish-yellow (10YR 6/8) mottles; massive; firm, slightly sticky and slightly plastic; few semirounded pebbles; strongly acid.

[1] Italic numbers in parentheses refer to Literature Cited, p. 117.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Abell fine sandy loam, 2 to 6 percent slopes	823	0.6
Altavista fine sandy loam, 0 to 2 percent slopes	1,094	.7
Altavista fine sandy loam, 2 to 6 percent slopes	585	.4
Angie loam, 0 to 2 percent slopes	3,211	2.4
Angie loam, 2 to 6 percent slopes	813	.5
Angie loam, 2 to 6 percent slopes, eroded	463	.3
Angie loam, 6 to 10 percent slopes, eroded	405	.3
Angie loam, 10 to 25 percent slopes, eroded	234	.2
Angie loam, concretionary subsoil variant	217	.1
Appling fine sandy loam, 2 to 6 percent slopes	3,893	2.7
Appling fine sandy loam, 6 to 15 percent slopes, eroded	2,826	1.9
Appling fine sandy loam, 15 to 25 percent slopes, eroded	163	.1
Appling clay loam, 2 to 15 percent slopes, severely eroded	242	.2
Aquents, loamy	100	.1
Ashlar gravelly sandy loam, 6 to 15 percent slopes	630	.4
Ashlar gravelly sandy loam, 15 to 45 percent slopes	571	.4
Atlee very fine sandy loam	6,648	4.6
Bertie fine sandy loam	1,254	.8
Bourne fine sandy loam, 0 to 2 percent slopes	325	.2
Bourne fine sandy loam, 2 to 6 percent slopes	3,041	2.2
Bourne fine sandy loam, 6 to 10 percent slopes	381	.3
Buncombe loamy fine sand	225	.2
Caroline very fine sandy loam, 2 to 6 percent slopes, eroded	4,110	2.8
Caroline very fine sandy loam, 6 to 10 percent slopes, eroded	2,485	1.8
Caroline very fine sandy loam, 10 to 15 percent slopes, eroded	297	.2
Caroline clay loam, 2 to 10 percent slopes, severely eroded	732	.5
Cecil fine sandy loam, 2 to 10 percent slopes, eroded	188	.1
Cecil fine sandy loam, 10 to 25 percent slopes, eroded	129	.1
Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded	195	.1
Chastain silt loam	1,277	.8
Chewacla silt loam	2,034	1.5
Chewacla silt loam, clayey substratum	177	.1
Chewacla and Riverview soils	3,802	2.7
Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes	8,699	6.0
Coxville silt loam	1,057	.7
Creedmoor sandy loam, 2 to 6 percent slopes	420	.3
Creedmoor sandy loam, 2 to 6 percent slopes, eroded	529	.4
Creedmoor sandy loam, 6 to 10 percent slopes, eroded	250	.2
Duplin very fine sandy loam, 2 to 6 percent slopes, eroded	2,848	2.0
Duplin very fine sandy loam, 6 to 10 percent slopes, eroded	2,734	1.9
Duplin very fine sandy loam, 10 to 15 percent slopes, eroded	218	.2
Duplin silt loam, 0 to 2 percent slopes	409	.3
Duplin clay loam, 2 to 10 percent slopes, severely eroded	770	.5
Faceville fine sandy loam, 0 to 2 percent slopes	117	.1
Faceville fine sandy loam, 2 to 6 percent slopes, eroded	297	.2
Fluvaquents	1,279	.9
Forestdale silt loam	241	.2
Helena fine sandy loam, 2 to 6 percent slopes	1,089	.7
Helena fine sandy loam, 2 to 6 percent slopes, eroded	1,316	1.0
Helena fine sandy loam, 6 to 15 percent slopes, eroded	420	.3
Hydraquents	287	.2
Kalmia fine sandy loam, 0 to 2 percent slopes	204	.1
Kalmia fine sandy loam, 2 to 10 percent slopes	136	.1
Kempsville fine sandy loam, 0 to 2 percent slopes	637	.4
Kempsville fine sandy loam, 2 to 6 percent slopes	1,064	.7
Kempsville fine sandy loam, 2 to 10 percent slopes, eroded	269	.2
Kempsville fine sandy loam, 10 to 25 percent slopes, eroded	314	0.2
Kempsville fine sandy loam, flooded, 0 to 2 percent slopes	279	.2
Kempsvlle fine sandy loam, flooded, 2 to 6 percent slopes	349	.2
Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes	7,794	5.4
Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes	2,789	2.0
Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded	152	.1
Kinston silt loam	2,141	1.6
Kinston and Mantachie soils	3,967	2.8
Lenoir silt loam	4,182	.9
Lynchburg fine sandy loam	4,050	2.7
Mantachie-Chastain complex	888	.6
Mayodan fine sandy loam, 2 to 6 percent slopes, eroded	339	.3
Myatt fine sandy loam	888	.6
Norfolk fine sandy loam, 0 to 2 percent slopes	1,247	.8
Norfolk fine sandy loam, 2 to 6 percent slopes	3,106	2.1
Norfolk fine sandy loam, 6 to 10 percent slopes	1,305	.8
Ochrepts and Udults, sloping	2,494	1.6
Ochrepts and Udults, steep	4,373	3.0
Orange loam	171	.1
Orthents-Udults-Mine pits complex	271	.2
Pactolus loamy fine sand	185	.1
Pamunkey fine sandy loam, 0 to 2 percent slopes	1,969	1.4
Pamunkey fine sandy loam, 2 to 6 percent slopes	1,574	1.0
Pamunkey fine sandy loam, 6 to 15 percent slopes	1,051	.7
Pamunkey clay loam, 6 to 15 percent slopes, severely eroded	174	.1
Pinkston fine sandy loam, 6 to 25 percent slopes	254	.2
Portsmouth silt loam	220	.2
Pouncey sandy loam	3,524	2.4
Psamments, gently sloping	237	.2
Rains very fine sandy loam	1,654	1.1
Riverview silt loam	590	.4
Roanoke silt loam	1,403	.9
Rumford loamy sand, 0 to 10 percent slopes	499	.3
Ruston fine sandy loam, 0 to 2 percent slopes	325	.2
Ruston fine sandy loam, 2 to 6 percent slopes	656	.5
Ruston fine sandy loam, 6 to 10 percent slopes, eroded	163	.1
Sassafras fine sandy loam, 0 to 2 percent slopes	186	.1
Sassafras fine sandy loam, 2 to 6 percent slopes	603	.4
State fine sandy loam, clayey substratum, 0 to 2 percent slopes	413	.3
State fine sandy loam, clayey substratum, 2 to 6 percent slopes	2,437	1.7
State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded	246	.2
State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes	149	.1
Tetotum fine sandy loam	681	.4
Tetotum loam, flooded	868	.6
Toccoa fine sandy loam	405	.2
Turbeville fine sandy loam, 0 to 2 percent slopes	211	.1
Turbeville fine sandy loam, 2 to 6 percent slopes	1,176	.8
Turbeville fine sandy loam, 6 to 10 percent slopes, eroded	340	.2
Turbeville gravelly fine sandy loam, 2 to 6 percent slopes	118	.1
Turbeville gravelly fine sandy loam, 6 to 10 percent slopes	102	.1
Udorthents, clayey	100	.1
Udorthents, loamy	1,734	1.3
Urban land	5,088	3.8
Wedowee sandy loam, 2 to 6 percent slopes	2,087	1.3
Wedowee sandy loam, 6 to 15 percent slopes	1,486	1.1
Gravel pits	1,797	1.2
Water (James River)	1,896	1.5
Total	146,560	100.0

The solum ranges from 36 to 47 inches in thickness. It is generally 3 to 10 percent pebbles, but in places the B23t horizon is as much as 35 percent pebbles. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR and 7.5YR, value is 4 or 5, and chroma is 3 to 6. In the Bt horizon hue ranges from 5YR to 10YR, value is 4 or 5, and chroma is 6 to 8. This horizon is commonly clay loam but ranges to sandy clay loam and heavy loam. The IIB23t horizon is gravelly clay loam, gravelly sandy clay loam, and gravelly loam. In places the C horizon is also gravelly.

Abell soils are similar to soils in the Kalmia, Pamunkey, and State series. Unlike these soils, however, Abell soils have a nonconforming IIB2t horizon. Also, their solum contains less sand than those of Kalmia and Pamunkey soils and less silt than the solum of State soils.

Abell soils are commonly near Appling, Cecil, and Colfax soils. Their Bt horizon is less clayey than those in the Appling and Cecil soils, and Abell soils do not have the fragipan that is characteristic of Colfax soils.

Abell fine sandy loam, 2 to 6 percent slopes (AbB).—This soil is in slight depressions, on small foot slopes, and in slightly concave areas at the heads of drainageways.

Included with this soil in mapping are small areas where the areas are more silty or more sandy than this one and small areas where the surface layer is gravelly. Also included are a few small areas of Appling and Colfax soils.

Runoff is slow to medium on this soil, and the soil is not droughty under normal climatic conditions. Areas of this soil are occasionally flooded. The soil is friable and easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops, hay, and pasture, and most of the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 2o1.

Altavista Series

The Altavista series consists of deep, moderately well drained, nearly level to gently sloping soils that have a loamy subsoil. These soils formed in loamy alluvium, mostly on terraces.

In a representative profile the surface layer is fine sandy loam 19 inches thick. It is dark grayish brown in the upper part and light olive brown in the lower part. The subsoil is sandy clay loam 31 inches thick. It is yellowish brown and brown in the upper part and gray in the lower part and is mottled with gray and reddish yellow below a depth of 32 inches. The substratum, at a depth of about 50 inches, extends to a depth of 103 inches or more. It is light brownish-gray and strong-brown sandy loam.

Available water capacity is medium in Altavista soils. A seasonal high water table is at a depth of 2½ to 3½ feet in winter and early in spring. Reaction is very strongly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Altavista fine sandy loam, 0 to 2 percent slopes, one-fourth mile east of U.S. Highway 1, 1,700 feet south of the Chickahominy River, and 400 feet north of Halfsink Road:

O1—1 inch to 0, partly decomposed leaves, pine needles, and twigs.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many coarse, medium and fine roots; strongly acid; abrupt, smooth boundary.

A2—5 to 19 inches, light olive-brown (2.5Y 5/4) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many coarse, medium and fine roots; few fine pores; very strongly acid; clear, smooth boundary.

B21t—19 to 32 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common medium and fine roots; few fine pores; thin, patchy clay films; very strongly acid; clear, smooth boundary.

B22t—32 to 42 inches, brown (10YR 5/3) sandy clay loam; many medium, distinct, reddish-yellow (5YR 6/8) and gray (10YR 6/1) mottles; weak, coarse, angular blocky structure; friable, slightly sticky and nonplastic; few medium and fine roots; few rounded pebbles; few mica flakes; thin, patchy clay films; very strongly acid; gradual, smooth boundary.

B3t—42 to 50 inches, gray (10YR 6/1) sandy clay loam; many medium, distinct, reddish-yellow (7.5YR 6/8) mottles; weak, coarse, subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; few mica flakes; thin, patchy clay films; very strongly acid; gradual, smooth boundary.

C—50 to 103 inches, layers of light brownish-gray (10YR 6/2) and strong-brown (7.5YR 5/6) sandy loam; massive; very friable, nonsticky and nonplastic; few mica flakes; clay content increases with increasing depth; very strongly acid.

The solum ranges from about 44 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Content of pebbles ranges from 0 to 10 percent throughout the solum.

In the A horizon value is 4 to 6 and chroma is 2 to 6. This horizon is fine sandy loam and loam.

In the Bt horizon hue is 10YR and 7.5YR, value is 5 or 6, and chroma is 1 to 8. Mottles that have chroma of 2 or less are present in the upper 24 inches of the Bt horizon. The Bt horizon is generally sandy clay loam but ranges from light sandy clay loam to clay loam.

The C horizon is commonly loamy but ranges from sand and gravel to clay.

Altavista soils are similar to soils in the Angie, Bertie, and Tetotum series. They contain less silt than the Angie soils, and the Bt horizons are less clayey. They are better drained than Bertie soils and do not have gray coatings on ped surfaces in the upper part of the subsoil, as is characteristic in Bertie soils. Altavista soils have mica flakes in the lower part of the Bt horizon and substratum, and Tetotum soils do not.

Altavista soils are commonly near Angie, Bertie, Buncombe, Chastain, Pamunkey, Riverview, and Roanoke soils. They are less well drained than sandy Buncombe and Pamunkey soils and have yellower Bt horizons. They contain less silt than Riverview soils and contain less clay and are better drained than Chastain and Roanoke soils.

Altavista fine sandy loam, 0 to 2 percent slopes (AfA).—This soil is on broad river terraces. It has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Angie, Lenoir, and Pamunkey soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. A few areas are occasionally flooded. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is used for cultivated crops or pasture, and some is wooded. This soil is well suited to most crops commonly grown in the county. Alfalfa is generally short lived because of excess wetness in winter and early in spring. Capability unit IIw–2; woodland suitability group 2o1.

Altavista fine sandy loam, 2 to 6 percent slopes (AfB).—This soil is on broad river terraces. It has a profile similar to the one described as representative of the series, but the surface layer is about 4 to 6 inches thinner in some places.

Included with this soil in mapping are small areas of Lenoir and Pamunkey soils. Lenoir soils are in small, low-lying areas. Also included are some gravelly soils.

Runoff is slow to medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for crops sensitive to excess moisture.

Most of the acreage of this soil is used for cultivated crops, hay, and pasture, but some is wooded. This soil is well suited to most crops commonly grown in the county. Alfalfa is generally short lived because of excess wetness in winter and early in spring. Capability unit IIe–2; woodland suitability group 2o1.

Angie Series

The Angie series consists of deep, moderately well drained, nearly level to moderately steep soils that have a thick, dominantly clayey subsoil. These soils formed in loamy and clayey alluvium on terraces of rivers and streams.

In a representative profile the surface layer is pale-brown loam about 8 inches thick. The subsoil is about 64 inches thick. The upper 7 inches is yellowish-brown clay loam. The next 57 inches is light silty clay that ranges from light yellowish brown and yellowish brown to strong brown in the upper part and light gray in the lower part. Gray and yellowish-red mottles are at a depth of 24 inches. The substratum extends from a depth of 72 inches to 88 inches or more and is gray silty clay that has yellowish-brown mottles.

Available water capacity is medium in Angie soils. Reaction is strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 1½ to 2½ feet in winter and in spring.

Representative profile of Angie loam, 0 to 2 percent slopes, one-half mile north of State Route 156 and three-fourths mile west of Carter's Mill:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

Ap—0 to 8 inches, pale-brown (10YR 6/3) loam; moderate, fine, granular structure; friable, slightly sticky and slightly plastic; common coarse, medium and fine roots; common fine pores; strongly acid; abrupt, wavy boundary.

B1t—8 to 15 inches, yellowish-brown (10YR 5/4) clay loam; few fine, faint, strong-brown (7.5YR 5/6) and pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; firm, sticky and plastic; few coarse, medium and fine roots; few fine pores; few fine mica flakes; thin, patchy clay films; strongly acid; clear, smooth boundary.

B21t—15 to 24 inches, light yellowish-brown (10YR 6/4) light silty clay; many medium, faint, strong-brown (7.5YR 5/8) and very pale brown (10YR 7/3) mottles; moderate, medium, angular blocky structure; firm, sticky and plastic; few medium and fine roots; few fine pores; few fine mica flakes; thin, continuous clay films; strongly acid; clear, smooth boundary.

B22t—24 to 60 inches, yellowish-brown (10YR 5/6) light silty clay; many medium, distinct, light-gray (10YR 6/1) and yellowish-red (5YR 5/8) mottles; moderate, coarse, prismatic structure that parts to moderate, medium, angular blocky; firm, sticky and plastic; few medium and fine roots; few fine pores; few manganese concretions; few fine mica flakes; thin, continuous clay films; strongly acid; gradual, smooth boundary.

B3tg—60 to 72 inches, strong-brown (7.5YR 5/6) and light-gray (10YR7/1) light silty clay; weak, coarse, angular blocky structure; firm, sticky and plastic; few medium and fine roots; few manganese concretions; few fine mica flakes; thin continuous clay films; strongly acid; gradual, smooth boundary.

Cg—72 to 88 inches, gray (5Y 6/1) silty clay; many coarse, prominent, yellowish-brown (10YR 5/4) mottles; massive; very firm, sticky and plastic; few fine mica flakes; strongly acid.

The solum is more than 60 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR, value is 4 to 6, and chroma is 2 or 3. Texture is commonly loam but ranges to very fine sandy loam and silt loam.

In the Bt horizon hue is 10YR or 7.5YR, value is 5 or 6, and chroma is 4 to 8. Mottles of chroma 2 or less commonly are within the upper 24 inches of the Bt horizon. The Bt horizon is generally light silty clay but ranges to silty clay and clay.

The C horizon ranges from gray to strong brown and yellowish brown and is commonly silty clay or clay.

Angie soils are similar to soils in the Altavista, Atlee, Caroline, Duplin, and Tetotum series. They have a thicker solum, less sand, and more clayey Bt horizons than the Altavista and Tetotum soils. They do not have the weak fragipan that is characteristic of Atlee soils. They have yellower Bt horizons and have gray mottles at a depth of about 24 inches, which are not characteristic of Caroline soils. They have less sand and more silt than Duplin soils. They have mica flakes in the Bt horizon and substratum, and Duplin soils do not.

Angie soils are commonly near Altavisa, Pamunkey, and Roanoke soils. They have more clayey and yellower Bt horizons and are not as well drained as Pamunkey soils. They are better drained than Roanoke soils, which have gray Bt horizons.

Angie loam, 0 to 2 percent slopes (AgA).—This soil is in broad river terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Lenoir soils in slight depressions. Also included are small areas of well-drained Pamunkey soils that are in a few slightly elevated areas.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable but is cloddy if it is tilled when too wet or too dry. The hazard of erosion is slight. A few areas are occasionally flooded. Drainage is desirable if the soil is used for farming.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This

soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIw–2; woodland suitability group 3o1.

Angie loam, 2 to 6 percent slopes (AgB).—This soil is on broad river terraces.

Included with this soil in mapping are small areas poorly drained of Lenoir soils in depressions. Also included are small areas of well-drained Pamunkey soils in slightly elevated areas.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable but is cloddy if it is tilled when too wet or too dry. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIe–2; woodland suitability group 3o1.

Angie loam, 2 to 6 percent slopes, eroded (AgB2).—This soil is in a few areas where the upper part of the subsoil has been mixed into the surface layer by plowing. It has a thinner surface layer than the one in the profile described as representative of the series. The surface layer is loam.

Included with this soil in mapping are small areas of well-drained Pamunkey soils. Also included are small areas where the subsoil has been exposed by erosion.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable, but it is cloddy if it is tilled when too wet or too dry. The hazard of further erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This soil is suited to most crops commonly grown in the county, except alfalfa. Capability unit IIe–2; woodland suitability group 3o1.

Angie loam, 6 to 10 percent slopes, eroded (AgC2).—This soil is in some areas where the upper part of the subsoil has been mixed into the surface layer by plowing. It has a thinner surface layer than the one in the profile described as representative of the series. The surface layer is loam.

Included with this soil in mapping are small areas of well-drained Pamunkey soils. Also included are small areas where the subsoil has been exposed by erosion.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. This soil is friable but is cloddy if it is tilled when too wet or too dry. Small seeps and wet spots often are at the base of slopes. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIIe–2; woodland suitability group 3o1.

Angie loam, 10 to 25 percent slopes, eroded (AgE2).—This soil is in narrow, sloping to moderately steep areas on river terraces. In places the upper part of the subsoil has been mixed into the surface layer by plowing. The surface layer of this soil is thinner than the one described as representative of the series. The subsoil is not as thick as the one described as representative of the series. The surface layer is loam.

Included with this soil in mapping are small areas of gravelly soils, small areas of sandy soils, and small areas where the subsoil has been exposed by erosion. Also included are small areas of soils that have light clay subsoils in a solum that is 40 to 50 inches thick.

Runoff is rapid on this soil, and the soil is somewhat droughty under prevailing climatic conditions. Small seeps and wet spots are near the base of slopes. The hazard of further erosion is severe if the soil is disturbed and left without plant cover.

Much of the acreage of this soil is wooded. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IVe–3; woodland suitability group 3r1.

Angie Variant

The Angie Variant consists of deep, moderately well drained, nearly level soils that have black concretions that make up about 50 percent, by volume, of the subsoil below a depth of 30 inches. These soils formed in loamy and clayey alluvium on terraces of rivers and streams.

In a representative profile the surface layer is dark-brown loam 7 inches thick. The subsoil is about 99 inches thick. The upper 23 inches is brown heavy silty clay loam. The lower 76 inches of the subsoil is brown silty clay loam that is about 50 percent, by volume, large black concretions.

Available water capacity is medium in Angie soils, concretionary subsoil variant. Reaction is strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 1½ to 2½ feet in winter and in spring.

Representative profile of Angie loam, concretionary subsoil variant, three-eighths mile west of Eaves Lake, 50 feet east of electric line pole No. 41434:

O1—½ inch to 0, partly decomposed pine needles, leaves, and twigs.

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) loam; moderate, fine, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; few fine pores; few rounded pebbles; strongly acid; abrupt, smooth boundary.

B21t—7 to 21 inches, brown (7.5YR 4/4) heavy silty clay loam; weak, medium, subangular blocky structure; firm, sticky and plastic; few fine roots; few fine pores; thin, patchy clay films; strongly acid; gradual, smooth boundary.

B22t—21 to 30 inches, brown (7.5YR 4/4) heavy silty clay loam; weak, medium, subangular blocky structure; firm, sticky and plastic; few fine roots; few large concretions; thin, patchy clay films; strongly acid; gradual, smooth boundary.

B3tcn—30 to 106 inches, brown (7.5YR 4/4) silty clay loam; common coarse, prominent, gray (5Y 6/1) mottles; weak, coarse, angular blocky structure; firm, sticky and plastic; compact in place; few fine roots in upper part; 50 percent large, black concretions, by volume; thin, patchy clay films; strongly acid.

The solum is more than 60 inches in thickness. Depth to bedrock is more than 5 feet. Depth to the concretionary horizon is commonly about 30 inches but ranges from a depth of 24 to 40 inches.

In the A horizon hue ranges from 7.5YR to 10YR, value is 4, and chroma is 2 to 4. Texture ranges from loam to silty loam and very fine sandy loam.

In the Bt horizon hue is 7.5YR, value is 4 or 5, and chroma is 4 to 6. Mottles of chroma 2 or less are commonly within the upper 24 inches of the B2t horizon. The Bt horizon above the concretionary layer is heavy silty clay loam or light silty clay. The concretionary layer is commonly silty clay loam.

Angie soils, concretionary subsoil variant, are similar to soils in the Altavista, Duplin, and Tetotum series. They have a more clayey Bt horizon than Altavista and Tetotum soils, and they contain less sand and more silt in the Bt horizon than Duplin soils. They have a concretionary lower layer of subsoil which is not characteristic of Altavista, Duplin, and Tetotum soils.

Angie soils, concretionary subsoil variant, are near Angie, Altavista, Pamunkey, and Riverview soils. They have a concretionary lower layer of subsoil that is not characteristic of Pamunkey and Riverview soils, and they are less well drained than Pamunkey and Riverview soils.

Angie loam, concretionary subsoil variant (Ak).—This nearly level soil is on broad river terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Angie soils without the concretionary layer of subsoil. Also included are small areas of well-drained Pamunkey soils in slightly elevated areas.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable but is cloddy if it is tilled when too wet or too dry. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This soil is suited to most crops commonly grown in the county, except for crops that are sensitive to excess wetness. Capability unit IIw–2; woodland suitability group 3o1.

Appling Series

The Appling series consists of deep, well-drained, gently sloping to moderately steep soils that have a dominantly clayey subsoil. These soils formed in material weathered from granite and gneiss (fig. 2).

In a representative profile the surface layer is fine sandy loam about 12 inches thick. It is brown in the upper part and yellowish brown in the lower part. The subsoil is about 46 inches thick. The upper 4 inches is yellowish-brown sandy clay loam. The remaining 42 inches of the subsoil is strong-brown clay. Red, yellowish-brown, and pale-brown mottles are in the lower part of the subsoil. The substratum extends from a

Figure 2.—**Granite boulders in some areas of Appling fine sandy loam make grading costly and difficult.**

depth of 58 to 94 inches or more and is red sandy clay loam that has white mottles.

Available water capacity is medium in Appling soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability is moderate.

Representative profile of Appling fine sandy loam, 2 to 6 percent slopes, one-fourth mile northwest of Pinchback School, 50 feet northeast of Gayton Road:

Ap—0 to 8 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; friable, nonsticky and nonplastic; many medium and fine roots; few angular quartz pebbles; strongly acid; clear smooth boundary.

A2—8 to 12 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; friable, nonsticky and nonplastic; many medium and fine roots; few angular quartz pebbles; strongly acid; gradual, smooth boundary.

B1t—12 to 16 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; many medium and fine roots; common medium and fine pores; few angular quartz pebbles; thin patchy clay films; very strongly acid; gradual, smooth boundary.

B2t—16 to 37 inches, strong-brown (7.5YR 5/6) clay; moderate, coarse, angular blocky structure; firm, sticky and plastic; few medium and fine roots; few medium and fine pores; thin, continuous, clay films; very strongly acid; gradual, smooth boundary.

B3t—37 to 58 inches, strong-brown (7.5YR 5/6) clay; many medium, prominent, weak-red (10R 4/4) mottles; weak, coarse, subangular blocky structure; firm, sticky and plastic; few cobbles of strongly weathered granite; few fine mica flakes; thin, patchy clay films; very strongly acid; gradual, irregular boundary.

C—58 to 94 inches, red (2.5YR 5/8) sandy clay loam; few fine, prominent, white (5Y 8/1) mottles; massive; horizon is strongly weathered granite; common fine mica flakes; very strongly acid.

The solum ranges from 48 to 58 inches in thickness. Depth to bedrock is more than 5 feet. Angular quartz pebbles, less than 1 percent to about 5 percent, by volume, are commonly in the A horizon, and in some places are throughout the solum.

In the A horizon hue is 10YR and 2.5Y, value is 4 to 6 and chroma is 2 to 6. The A horizon is dominantly fine sandy loam and ranges to sandy loam.

In the Bt horizon hue is 5YR to 10YR, value is 5 or 6, and chroma is 6 to 8. The Bt horizon is clay and heavy clay loam. Red mottles are often in the lower part of the Bt horizon.

The C horizon is red or yellowish-red, strongly weathered granite or gneiss. White, brown, and yellowish-brown mottles are in many places throughout the C horizon.

Appling soils are similar to soils in the Cecil, Helena, and Mayodan series. They have yellower Bt horizons than Cecil soils. They are better drained than Helena soils and do not have mottles of chroma 2 or less in the upper 24 inches of the Bt horizon, as is characteristic in Helena soils. They are more yellow in the lower part of the B horizon than Mayodan soils.

Appling soils are commonly near Ashlar, Bourne, Cecil, Colfax, and Helena soils. They have clayey Bt horizons which Ashlar soils do not have. They do not have the fragipan that is characteristic of Bourne and Colfax soils.

Appling fine sandy loam, 2 to 6 percent slopes (AmB).—This soil is on somewhat broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne and Helena soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable, and it is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and about three-fourths is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Appling fine sandy loam, 6 to 15 percent slopes, eroded (AmC2).—This soil is on smooth side slopes. The surface layer is commonly 4 to 8 inches thick. The surface layer is sandy clay loam in areas where the upper part of the subsoil has been mixed into the surface layer by plowing.

Included with this soil in mapping are small areas of Ashlar, Bourne, and Helena soils. Also included are small areas of gravelly soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fifth of the acreage of this soil is used for cultivated crops or pasture, and nearly four-fifths is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Appling fine sandy loam, 15 to 25 percent slopes, eroded (AmE2).—This soil is on smooth side slopes and the lower parts of some hillsides. The surface layer is commonly 4 to 6 inches thick. The subsoil is slightly thinner in many places. The surface layer is sandy clay loam in places where the upper part of the subsoil has been mixed into the surface layer by plowing.

Included with this soil in mapping are small areas of Ashlar and Wedowee soils. Also included are small areas of gravelly soils.

Runoff is rapid on this soil, and the soil is slightly droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded. This soil has limited suitability for most crops commonly grown in the county. Capability unit IVe–1; woodland suitability group 3r1.

Appling clay loam, 2 to 15 percent slopes, severely eroded (AoC3).—This soil is on side slopes and narrow ridges. The surface layer is commonly a clay loam plow layer that is 4 to 6 inches thick. It formed from a mixture of surface soil and subsoil. In many places the subsoil is somewhat thinner than the one described as representative of the series.

Included with this soil in mapping are small areas of Ashlar and Wedowee soils. Also included are small gravelly areas and small gullied areas.

Runoff is medium to rapid on this soil, and the soil is slightly droughty under prevailing climatic conditions. This soil is difficult to till and is cloddy if it is

tilled when too wet or too dry. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Some of the acreage of this soil is used for cultivated crops or pasture, and most of it is wooded. This soil has limited suitability for most crops commonly grown in the county. Capability unit IVe–2; woodland suitability group 4c1.

Aquents

Aquents, loamy (AQ), consists of areas of land covered by several feet of soil materials dredged from the channel of the James River. It is dominantly silt loam or loam and is poorly drained. Permeability is slow in these soil materials. Reaction is medium acid to strongly acid. Slopes are commonly 0 to 2 percent.

Included with Aquents in mapping are small areas of Chastain and Chewacla soils.

Runoff is slow on these soil materials. The soil materials are frequently flooded. They have limited suitability for farming. Capability unit VIw–1; woodland suitability group unclassifed.

Ashlar Series

The Ashlar series consists of moderately deep, somewhat excessively drained or excessively drained, sloping to steep soils that have a loamy subsoil. These soils formed in material weathered from granite and gneiss.

In a representative profile the surface layer is dark yellowish-brown gravelly sandy loam 7 inches thick. The subsoil is strong-brown sandy loam 7 inches thick. The substratum extends from a depth of 14 to 40 inches and is dark-brown, white, and black sandy loam that has many hard rock fragments. It is made up of strongly weathered granite. Bedrock is at a depth of about 40 inches.

Available water capacity is low in Ashlar soils. Reaction is very strongly acid to strongly acid. Permeability in the subsoil is moderately rapid.

Representative profile of Ashlar gravelly sandy loam, 15 to 45 percent slopes, three-fourths mile north of Hunton, 300 feet east of R.F. & P. Railroad:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

A1—0 to 7 inches, dark yellowish-brown (10YR 4/4) gravelly sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many large, medium, fine roots; few fine mica flakes; very strongly acid; abrupt, smooth boundary.

B—7 to 14 inches, strong-brown (7.5YR 5/6) sandy loam; weak, fine, subangular blocky structure; very friable, nonsticky and nonplastic; common medium and fine roots; few fine mica flakes; very strongly acid; gradual, wavy boundary.

C—14 to 40 inches, dark-brown (7.5YR 4/4), white (5Y 8/1), and black (10YR 2/1) sandy loam; massive; common medium and fine roots; few fine mica flakes; rock fragments 35 percent, by volume; horizon is strongly weathered granite; strongly acid; gradual, irregular boundary.

R—40 inches, weathered granite.

The solum ranges from 14 to 24 inches in thickness. Depth to bedrock ranges from 24 to 40 inches. Fragments of granite or gneiss range from 0 to about 20 percent, by volume, in the solum and from 10 to 35 percent, by volume, in the C horizon.

In the A horizon value is 4 to 6 and chroma is 2 to 4. In the B horizon hue is 7.5YR and 10YR, and chroma is 4 to 8. The C horizon is dark brown, brown, strong brown, and yellowish brown mixed with white and black.

Ashlar soils are similar to soils in the Pinkston and Wedowee series. They have a slightly coarser textured solum than Pinkston soils, and depth to bedrock is slightly more. They have mica flakes in the B and C horizons, and Pinkston soils do not. They do not have the Bt horizons that are characteristic of Wedowee soils.

Ashlar soils are commonly near Appling, Bourne, and Cecil soils. They do not have the clayey Bt horizons of Appling and Cecil soils. They do not have the fragipan that is characteristic of Bourne soils.

Ashlar gravelly sandy loam, 6 to 15 percent slopes (AsD).—This soil is on moderately long side slopes.

Included with this soil in mapping are small areas of well-drained Appling, Cecil, and Wedowee soils, small areas of cobbly soils, and small areas of rock outcrops.

Runoff is medium to rapid on this soil, and the soil is somewhat excessively drained. The soil is droughty under prevailing climatic conditions. The hazard of erosion is very severe if the soil is disturbed and left without plant cover.

Most of the acreage of this soil is wooded. This soil has limited suitability for most crops commonly grown in the county. It is suited to the pasture plants that are commonly grown in the county and that are drought resistant. Capability unit IVe–4; woodland suitability group 3d1.

Ashlar gravelly sandy loam, 15 to 45 percent slopes (AsE).—This soil is on side slopes and hillsides. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of cobbly soils and rock outcrops.

Runoff is rapid on this soil, and it is excessively drained. The soil is droughty under prevailing climatic conditions. The hazard of erosion is very severe if the soil is disturbed and left without plant cover.

Most of the acreage of this soil is wooded. Capability unit VIe–1; woodland suitability group 3d1.

Atlee Series

The Atlee series consists of deep, moderately well drained, nearly level soils that have a weak fragipan at a depth of 22 to 30 inches. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is very fine sandy loam and loam 12 inches thick. The upper part is dark grayish brown and the lower part is light yellowish brown. The layer of subsoil above the fragipan is light olive-brown light clay loam 10 inches thick. The weak fragipan is 32 inches thick. The upper part of the fragipan is pale-yellow and brownish-yellow light clay loam that has gray mottles. The lower part of the fragipan is light yellowish-brown, gray, and yellowish-red clay loam. The layer of subsoil below the fragipan is light yellowish-brown, gray, and yellowish-red clay 12 inches thick. The substratum, at a depth of 66 inches, extends to a depth of 102 inches or more. It is light yellowish-brown, gray, and yellowish-red clay.

Available water capacity is medium in Atlee soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability above the fragipan is moderate. Permeability in the fragipan is moderately slow. A seasonal high water table is at a depth of 1½ to 2½ feet in wet seasons.

Representative profile of Atlee very fine sandy loam, three-eigths mile south of Fort Lee at intersection of Charles City Road and C&O Railroad:

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) very fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many fine roots; strongly acid; abrupt, smooth boundary.

A2—4 to 12 inches, light yellowish-brown (2.5Y 6/4) loam; weak, fine, granular structure; friable, slightly sticky and nonplastic; common fine roots; few fine pores; very strongly acid; clear, smooth boundary.

B2t—12 to 22 inches, light olive-brown (2.5Y 5/4) light clay loam; weak, medium, subangular blocky structure; friable, sticky and slightly plastic; few fine roots; few fine pores; thin, patchy clay films; very strongly acid; clear, smooth boundary.

Bx1—22 to 33 inches, pale-yellow (2.5Y 7/4) and brownish-yellow (10YR 6/8) light clay loam; few medium, distinct, gray (5Y 6/1) mottles; moderate, very coarse, prismatic structure that parts to weak, medium, platy and weak, fine, subangular blocky; friable, sticky and slightly plastic; brittle and compact in part of the horizon; few fine roots; few medium and fine pores; thin, patchy clay films; very strongly acid; clear, smooth boundary.

Bx2—33 to 54 inches, light yellowish-brown (2.5Y 6/4), gray (10YR 6/1), and yellowish-red (5YR 4/6) clay loam; moderate, very coarse, prismatic structure that parts to weak, thick, platy and weak, coarse, subangular blocky; friable, sticky and slightly plastic; brittle and compact in part of horizon; thin, continuous clay films; very strongly acid; gradual, smooth boundary.

B3t—54 to 66 inches, light yellowish-brown (2.5Y 6/4), gray (10YR 6/1), and yellowish-red (5YR 4/6) clay; weak, thick, platy structure that parts to weak, fine, angular blocky; firm, sticky and plastic; thin, continuous clay films; very strongly acid; gradual, smooth boundary.

C—66 to 102 inches, light yellowish-brown (2.5Y 6/4), gray (10YR 6/1), and yellowish-red (5YR 4/6) clay; massive; firm, sticky and plastic; very strongly acid.

The solum ranges from 50 to 67 inches in thickness. Depth to the fragipan ranges from 22 to 30 inches. Depth to bedrock is more than 5 feet.

The A horizon ranges from very fine sandy loam to silt loam. In the Ap horizon hue is 10YR and 2.5Y, value is 4 or 5, and chroma is 2 to 4. In the A2 horizon hue is 2.5Y and 10YR, value is 5 or 6, and chroma is 2 to 4.

In the Bt horizon above the fragipan, hue is 2.5Y and 10YR, and chroma is 4 to 8. The Bt horizon ranges from light clay loam to heavy silt loam. In the Bx1 horizon hue is 2.5Y and 7.5YR, value is 5 to 7, and chroma is 4 to 8. Few to common gray mottles are often in the Bx1 horizon. The Bx2 horizon is light yellowish brown, yellowish brown, gray, and yellowish red. The Bx horizon ranges from light clay loam and clay loam to heavy silt loam. The B3t horizon is yellowish brown gray, and yellowish-red clay to light clay loam and light silty clay loam.

The C horizon is commonly light yellowish-brown, yellowish-brown, gray, and yellowish-red clay or clay loam.

Atlee soils are similar to soils in the Angie, Bourne, and Caroline series. They have a less clayey Bt horizon than Angie and Caroline soils and a weak fragipan which these soils do not have. They have a less strongly developed fragipan than Bourne soils and contain less sand and more silt throughout the solum.

Atlee soils are near Bourne, Caroline, Coxville, Duplin, Faceville, and Norfolk soils. They have a less clayey Bt horizon than Coxville and Duplin soils and have a fragipan which these soils do not have. They contain less sand throughout the solum than Norfolk soils and have a weak fragipan which these soils do not have.

Atlee very fine sandy loam (At).—This nearly level soil is on broad ridges. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Caroline, Duplin, Lynchburg, and Tetotum soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

About half of the acreage of this soil is used for cultivated crops and pasture, and much of the other half is wooded. This soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIw–2; woodland suitability group 3o1.

Bertie Series

The Bertie series consists of deep, somewhat poorly drained, nearly level soils that have a loamy subsoil. These soils formed in loamy alluvium and loamy Coastal Plain sediments.

In a representative profile the surface layer is fine sandy loam 9 inches thick. The upper part is very dark grayish brown; the lower part is light yellowish brown and has strong-brown mottles. The subsoil is 50 inches thick. The upper part of the subsoil is light olive-brown sandy clay loam that has yellowish-brown mottles. The central part of the subsoil is strong-brown sandy clay loam that has gray coatings on the ped surfaces. The lower part of the subsoil is strong-brown and gray fine sandy loam. The substratum, at a depth of 59 inches, extends to a depth of 82 inches or more and consists of layers of sand, loamy fine sand, and very gravelly fine sand that are gray, strong brown, and yellowish brown.

Available water capacity is medium in Bertie soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability is moderately slow. A seasonal high water table is at a depth of 1 to 1½ feet in wet seasons. The soils are occasionally flooded.

Representative profile of Bertie fine sandy loam, 1¼ miles northeast of Meadow Road, 1 mile north of the Southern Railroad, and 500 feet southwest of the Chickahominy River:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) fine sandy loam; weak, very fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; strongly acid; abrupt, smooth boundary.

A2—5 to 9 inches, light yellowish-brown (10YR 6/4) fine sandy loam; common fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; strongly acid; clear, smooth boundary.

B1—9 to 19 inches, light olive-brown (2.5Y 5/4) light sandy clay loam; many fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable, nonsticky and

nonplastic; few fine roots; strongly acid; clear, smooth boundary.

B2t—19 to 36 inches, strong-brown (7.5YR 5/6) sandy clay loam; many coarse, prominent, gray (5Y 6/1) mottles or coatings on ped surfaces; weak, coarse, subangular blocky structure; friable, nonsticky and nonplastic; few fine roots; few fine pores; thin, patchy clay films; very strongly acid; gradual, smooth boundary.

B3tg—36 to 59 inches, mottled, gray (5Y 6/1) and strong-brown (7.5YR 5/8) fine sandy loam; weak, coarse, subangular blocky structure; very friable, nonsticky and nonplastic; common pockets of white fine sand; few fine mica flakes; sand grains coated and bridged with clay; very strongly acid; abrupt, smooth boundary.

IIC—59 to 82 inches, layers of gray, strong-brown, and yellowish-brown sand, loamy fine sand, and very gravelly fine sand; massive; very friable, nonsticky and nonplastic; few mica flakes; very strongly acid.

The solum ranges from 30 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Mica flakes are commonly in the lower Bt and C horizons.

In the A horizon hue is 10YR and 2.5Y, value is 3 to 7 and chroma is 2 to 4.

In the B2t horizon hue is 10YR and 7.5YR, value is 4 to 8, and chroma is 4 to 6. In the B2t horizon coatings on the ped surfaces are gray. The B3tg horizon is dominantly gray and has gray mottles in some areas. The B2t horizon ranges from sandy clay loam to clay loam, and the B3tg horizon ranges from fine sandy loam to sandy clay loam.

The C horizon is gray, strong brown, and yellowish brown and is commonly sandy with layers of gravel.

Bertie soils are similar to soils in the Altavista, Lynchburg, and Tetotum series. They are less well drained than the Altavista and Tetotum soils and have gray mottles or coatings in the upper Bt horizon. They have mixed mineralogy and mica flakes in the lower Bt and C horizons, whereas Lynchburg soils have siliceous mineralogy and do not have mica flakes.

Bertie soils are commonly near Altavista, Buncombe, and Pactolus soils. They are less well drained and have less sand than the Buncome and Pactolus soils.

Bertie fine sandy loam (Be).—This nearly level soil is in low-lying areas and low stream terraces, often surrounded by areas of poorly drained soils. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of poorly drained Myatt soils that are in lower lying areas, small areas of excessively drained Buncombe soils, and moderately well drained Pactolus soils that are in slightly elevated areas. Also included are small areas of very gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but some is used for cultivated crops or pasture. This soil is suited to most crops commonly grown in the county, except those that are sensitive to excess moisture. Capability unit IIIw–1; woodland suitability group 3w1.

Bourne Series

The Bourne series consists of deep, moderately well drained, nearly level to sloping soils that have a fragipan at a depth of 18 to 30 inches. These soils formed in loamy Coastal Plain sediments.

In a representative profile the surface layer is fine sandy loam about 13 inches thick. It is grayish brown in the upper part and pale brown in the lower part. The subsoil above the fragipan is yellowish-brown sandy clay loam 5 inches thick. The fragipan is light yellowish-brown and yellowish-brown fine sandy loam 13 inches thick. It is brittle and compact in place. The subsoil below the fragipan, extending to a depth of 53 inches, is strong-brown, red, and brownish-yellow sandy clay loam that has light-gray mottles in the lower part. The substratum extends from a depth of 53 to 109 inches or more and is brownish-yellow, red, and light-gray sandy loam in the upper part and clay in the lower part.

Available water capacity is medium in Bourne soils. Reaction is very strongly acid in the subsoil, and permeability is moderate in the subsoil above the fragipan. However, permeability is slow to very slow in the fragipan. A seasonal high water table is perched above the fragipan during wet seasons.

Representative profile of Bourne fine sandy loam, 2 to 6 percent slopes, 2 miles north of Short Pump, 1 mile east of Shady Grove Church, one-fourth mile south of Shady Grove Road:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs, mottled with fine roots.

A1—0 to 2 inches, grayish-brown (10YR 5/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many large, medium, and fine roots; very strongly acid; abrupt, smooth boundary.

A2—2 to 13 inches, pale-brown (10YR 6/3) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common large, medium, and fine roots; very strongly acid; clear, smooth boundary.

B2t—13 to 18 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; few medium and fine roots; few fine pores; thin, patchy clay films; very strongly acid; clear, smooth boundary.

Bx—18 to 31 inches, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) fine sandy loam; moderate, very coarse, prismatic structure that parts to weak, medium, platy; firm, brittle and compact in place; nonsticky and nonplastic; few medium and fine roots between peds; common, medium, vesicular pores; thin, patchy clay films on horizontal ped surfaces; very strongly acid; clear, smooth boundary.

B31t—31 to 44 inches, strong-brown (7.5YR 5/8) sandy clay loam; few medium, distinct, red (2.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; thin, patchy clay films; very strongly acid; clear, smooth boundary.

B32t—44 to 53 inches, red (10R 4/8) and brownish-yellow (10YR 6/8) sandy clay loam; few medium, distinct, light-gray (10YR 7/1) mottles; weak, medium, angular blocky structure; friable, slightly sticky and nonplastic; few veins of grayish-brown (10YR 5/2) clay; thin, patchy clay films; very strongly acid; clear, wavy boundary.

IIC1—53 to 86 inches, brownish-yellow (10YR 6/8), red (2.5YR 5/8), and light-gray (10YR 7/2) sandy loam; massive; friable, nonsticky and nonplastic; very strongly acid; clear, wavy boundary.

IIIC2—86 to 109 inches, weak-red (10R 5/4), light-gray (10YR 7/1), and brownish-yellow (10YR 6/8) clay; massive; very firm, sticky and plastic; very strongly acid.

The solum ranges from 49 to 66 inches in thickness. Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 18 to 30 inches.

In the A1 horizon hue is 10YR, value is 4 or 5, and chroma is 2 or 3. In the A2 horizon hue, when present, is 10YR, value is 5 or 6, and chroma is 2 to 4. The A2 horizon ranges from fine sandy loam to very fine sandy loam and loam.

In the B2t horizon hue is 10YR and 7.5YR, and chroma is 4 to 8. The B2t horizon ranges from sandy clay loam to loam and clay loam. In the Bx horizon hue is 10YR, value is 5 or 6, and chroma is 2 to 6. The B3t horizon is strong brown or yellowish brown with gray mottles or is a mixture of strong brown, yellowish brown, brownish yellow, red, and gray. The B3t horizon ranges from sandy clay loam to clay loam.

The C horizon is mixed brownish-yellow, yellowish-brown, red, and gray sandy loam to clay.

Bourne soils are similar to soils in the Atlee, Caroline, Colfax, and Kempsville series. They contain more sand and less silt throughout the solum and have a more strongly developed fragipan than Atlee soils. They have a fragipan which is not characteristic of Caroline and Kempsville soils. They do not have gray mottles in the Bt horizon above the fragipan, as Colfax soils have.

Bourne soils are near Appling, Ashlar, Atlee, Caroline, Cecil, and Pouncey soils. They have a fragipan which is not characteristic of Appling, Ashlar, and Cecil soils. They have a less clayey Bt horizon and thicker solum than Pouncey soils and a fragipan that is not characteristic of these soils.

Bourne fine sandy loam, 0 to 2 percent slopes (BoA).—This soil is on broad ridges.

Included with this soil in mapping are small areas of well-drained Appling, Caroline, and Wedowee soils in slightly elevated and gently sloping areas, small areas of moderately well drained Atlee soils, and well-drained Kempsville soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is somewhat droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming. Slightly concave areas are sometimes ponded in winter and in spring.

Much of the acreage of this soil is wooded, but small areas are used for cultivated crops, hay, and pasture. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those crops that are sensitive to excess moisture. Capability unit IIw–2; woodland suitability group 4d1.

Bourne fine sandy loam, 2 to 6 percent slopes (BoB).—This soil is on broad ridges. It has a profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Appling, Caroline, Kempsville, Norfolk, and Wedowee soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

Much of the acreage of this soil is wooded, but some small areas are used for cultivated crops, hay, and pasture. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those crops that are sensitive to excess moisture or droughtiness. Capability unit IIe–2; woodland suitability group 4d1.

Bourne fine sandy loam, 6 to 10 percent slopes (BoC).—This soil is on smooth side slopes.

Included with this soil in mapping are small areas of well-drained Appling, Caroline, Kempsville, and Wedowee soils. Also included are small areas of gravelly soils.

Runoff is medium to rapid on this soil, and the soil is droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops, hay, and are in pasture. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those crops that are sensitive to excess moisture or droughtiness. Capability unit IIIe–2; woodland suitability group 4d1.

Buncombe Series

The Buncombe series consists of deep, excessively drained, nearly level sandy soils. These soils formed in sandy alluvium on high bottom lands.

In a representative profile the surface layer is dark grayish-brown loamy fine sand 10 inches thick. Between depths of 10 and 48 inches, the substratum is loamy fine sand. It is yellowish brown in the upper part and strong brown in the lower part. The upper part has seams and pockets of brown loamy fine sand. Between depths of 48 and 78 inches or more, the lower part of the substratum is mottled yellowish-brown and pale-brown sand.

Available water capacity is low in Buncombe soils. Reaction is strongly acid to very strongly acid throughout, and permeability is rapid in the substratum. These soils are occasionally flooded.

Representative profile of Buncombe loamy fine sand, 1½ mile southeast of Bottoms Bridge and Williamsburg Road, three-fourths mile east of the end of Windsor Road, 200 feet west of the Chickahominy River:

O1—1 inch to 0, undecomposed pine needles and leaves.

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; loose, nonsticky and nonplastic; many medium and fine roots; pine needles mixed in upper 3 inches; very strongly acid; abrupt, smooth boundary.

C1—10 to 32 inches, yellowish-brown (10YR 5/6) loamy fine sand; single grained; loose, nonsticky and nonplastic; common medium and fine roots; seams and small pockets of brown (10YR 4/3) loamy fine sand; few rounded pebbles; strongly acid; diffuse, wavy boundary.

C2—32 to 48 inches, strong-brown (7.5YR 5/6) loamy fine sand; single grained; loose, nonsticky and nonplastic; few medium and fine roots; few rounded pebbles; few fine mica flakes; very strongly acid; diffuse, wavy boundary.

C3—48 to 78 inches, mottled, yellowish-brown (10YR 5/4) and pale-brown (10YR 6/3) sand; single grained; loose, nonsticky and nonplastic; few ferriginous sandstone fragments; many rounded pebbles; con-

tent of pebbles increasing with increasing depth; few fine mica flakes; strongly acid.

The soil material consists of as much as 10 percent, by volume, of fine rounded pebbles. Depth to bedrock is more than 5 feet. Below a depth of about 48 inches content of pebbles ranges from less than 1 percent to more than 50 percent by volume. Fine mica flakes are commonly in the substratum below a depth of about 32 inches.

In the A horizon hue is 10YR and 2.5Y, value is 3 to 5, and chroma is 2 to 6.

In the C horizon hue is 10YR and 7.5YR to a depth of about 48 inches, value is 4 to 6, and chroma is 3 to 6. Below a depth of about 48 inches, the C horizon is commonly mottled yellowish brown, strong brown, and pale brown. The C horizon ranges from sand to very gravelly sand. Layers of finer textured materials are present in some places.

Buncombe soils are similar to soils in the Pactolus and Toccoa series. They do not have the gray mottles that are characteristic of Pactolus soils at a depth of about 28 inches. They are coarser and more acid in the solum above a depth of about 40 inches than Toccoa soils.

Buncombe soils are commonly near Altavista, Bertie, Myatt, and Pactolus soils. They are better drained and do not have the Bt horizons characteristic of Altavista, Bertie, and Myatt soils.

Buncombe loamy fine sand (Bu).—This nearly level soil is on broad, high bottom lands. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Pactolus and Toccoa soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil. The soil is droughty under prevailing climatic conditions. The soil is friable and easily tilled, but it is occasionally flooded. The hazard of erosion is slight.

Most of the acreage of this soil is wooded. This soil has a limited suitability for most crops commonly grown in the county. Capability unit IIIs–1; woodland suitability group 2s1.

Caroline Series

The Caroline series consists of deep, well-drained, gently sloping to sloping soils that have a thick, dominantly clayey subsoil. These soils formed in loamy and clayey Coastal Plain sediments.

In a representative profile the surface layer is pale-brown very fine sandy loam 5 inches thick. The subsoil is 109 inches thick. The upper 5 inches is yellowish-brown clay loam. The next 11 inches is strong-brown heavy clay loam, and below that 14 inches of yellowish-brown and red silty clay and 26 inches of red, light-gray, and light yellowish-brown clay. The lower 53 inches is yellowish-brown, light-gray, and red sandy clay loam. The substratum, at a depth of 114 inches, extends to a depth of 134 inches or more. It is brown and dark-brown fine sandy loam that has white mottles.

Available water capacity is medium in Caroline soils. Reaction is very strongly acid in the subsoil, and permeability is moderately slow in the subsoil.

Representative profile of Caroline very fine sandy loam, 6 to 10 percent slopes, eroded, 1⅝ miles southeast of Seven Pines, three-eighths mile south of Williamsburg Road, one-fourth mile east of Memorial Drive, and 200 feet north of Woods road:

O1—1 inch to 0, partly decomposed leaves and twigs.

Ap—0 to 5 inches, pale-brown (10YR 6/3) very fine sandy loam; moderate, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; very strongly acid; clear, smooth boundary.

B1t—5 to 10 inches, yellowish-brown (10YR 5/6) clay loam; weak, medium, subangular blocky structure; friable, sticky and slightly plastic; common medium and fine roots; few fine pores; thin, patchy clay films; very strongly acid; clear, smooth boundary.

B21t—10 to 21 inches, strong-brown (7.5YR 5/6) heavy clay loam; moderate, medium, subangular blocky structure; firm, sticky and plastic; common medium and fine roots; few fine pores; thin, continuous clay films; very strongly acid; clear, smooth boundary.

B22t—21 to 35 inches, yellowish-brown (10YR 5/8) and red (2.5YR 4/6) silty clay; moderate, thick, platy structure; firm, sticky and plastic; few fine roots; thin, continuous clay films; very strongly acid; gradual, smooth boundary.

B23t—35 to 61 inches, red (10R 4/6), light-gray (10YR 7/1), and light yellowish-brown (10YR 6/4) clay; moderate, thick, platy structure; firm, sticky and plastic; few fine roots; thin, patchy, brown (10YR 4/3) clay films; very strongly acid; clear, irregular boundary.

B3t—61 to 114 inches, yellowish-brown (10YR 5/4), light-gray (10YR 7/1), and red (10R 4/8) sandy clay loam; weak, coarse, angular blocky structure; firm, slightly sticky and slightly plastic; thin, patchy, brown (7.5YR 5/4) clay films; very strongly acid; gradual, smooth boundary.

C—114 to 134 inches, brown (7.5YR 5/4) and dark-brown (7.5YR 4/4) fine sandy loam; common fine, distinct, white (10YR 8/1) mottles; massive; friable, nonsticky and nonplastic; very strongly acid.

The solum is more than 60 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon value is 4 to 6, and chroma is 2 to 6. The A horizon is very fine sandy loam or fine sandy loam. Severely eroded soils are clay loam.

In the B2t horizon, above a depth of about 35 inches, color ranges from yellowish red (5YR 5/6) to strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6 and 5/8) and is commonly mixed with red (2.5YR 4/6) below a depth of about 21 inches. Below a depth of about 35 inches, color is a mixture of red (10R 4/6 and 4/8), light gray (10YR 7/1), light yellowish brown (10YR 6/4), and yellowish brown (10YR 5/4 and 5/6). The B2t horizon ranges from heavy clay loam to silty clay and clay. The B3t horizon is mixed yellowish-brown, light-gray, and red sandy clay loam to clay.

The C horizon is commonly brown, dark-brown, and strong-brown fine sandy loam but ranges to clay loam and clay.

Caroline soils are similar to soils in the Angie, Atlee, Bourne, Duplin, Faceville, Norfolk, and Turbeville series. They do not have mottles of chroma 2 or less in the upper 24 inches of the Bt horizon, as is characteristic in Angie and Duplin soils. They do not have the fragipan that is characteristic of Atlee and Bourne soils. They have less red Bt horizons than Faceville and Turbeville soils. They have gray colors in the lower part of the Bt horizon, and Faceville and Turbeville soils do not. They have a more clayey Bt horizon than Norfolk soils.

Caroline soils are near Atlee, Bourne, Duplin, Lynchburg, and Norfolk soils. They are better drained and have more clayey Bt horizons than Lynchburg soils.

Caroline very fine sandy loam, 2 to 6 percent slopes, eroded (CaB2).—This soil is on ridges and side slopes.

Included with this soil in mapping are small areas of moderately well drained Bourne and Duplin soils and small areas of well-drained Norfolk soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Caroline very fine sandy loam, 6 to 10 percent slopes, eroded (CaC2).—This soil is on side slopes and some narrow ridges. It has the profile described as representative of the series. In a few places, where the upper part of the subsoil has been mixed into the surface layer by plowing, the surface layer is clay loam.

Included with this soil in mapping are small areas of moderately well drained Duplin soils and well-drained Norfolk soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Caroline very fine sandy loam, 10 to 15 percent slopes, eroded (CaD2).—This soil is on side slopes. The solum is somewhat thinner than the one described as representative of the series. In some places, where the upper part of the subsoil has been mixed into the surface layer by plowing, the surface layer is clay loam.

Included with this soil in mapping are small areas of moderately well drained Duplin soils and small areas of well-drained Norfolk and Sassafras soils.

Runoff is rapid on this soil, and the soil is slightly droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops or pasture. This soil has a limited suitability for most crops commonly grown in the county. Capability unit IVe–1; woodland suitability group 3o1.

Caroline clay loam, 2 to 10 percent slopes, severely eroded (CbC3).—This soil is on narrow ridges and on side slopes. The solum is somewhat thinner than the one described as representative of the series. The surface layer is very fine sandy loam in less severely eroded soils. The clay loam plow layer is mostly subsoil.

Included with this soil in mapping are small areas of moderately well drained Duplin soils. Also included are small gullied areas.

Runoff is medium to rapid on this soil, and the soil is somewhat droughty under prevailing climatic conditions. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover.

About one-fourth of the acreage of this soil is used for pasture, and most of the rest is wooded. Capability unit IVe–2; woodland suitability group 4c1.

Cecil Series

The Cecil series consists of deep, well-drained, gently sloping to moderately steep soils that have a dominantly clayey subsoil. These soils formed in material weathered from granite and gneiss.

In a representative profile the surface layer is brown fine sandy loam about 9 inches thick. The subsoil is about 51 inches thick. The upper 5 inches is yellowish-red clay loam. The next 30 inches is red clay that has a few yellowish-brown mottles. The lower 16 inches is red and yellow clay loam. The substratum, at a depth of about 60 inches, extends to a depth of 114 inches or more. It is red sandy clay loam.

Available water capacity is medium in Cecil soils. Reaction is very strongly acid in the subsoil, and permeability is moderate.

Representative profile of Cecil fine sandy loam, 2 to 10 percent slopes, eroded, three-eighths mile east of Shady Grove Road and one-eighth mile south of the Chickahominy River.

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

Ap—0 to 9 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many large, medium, and fine roots; very strongly acid; clear, smooth boundary.

B1t—9 to 14 inches, yellowish-red (5YR 5/6) clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; common medium and fine roots; few fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.

B21t—14 to 29 inches, red (2.5YR 4/8) clay; few medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm, sticky and plastic; few medium and fine roots; few fine pores; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B22t—29 to 44 inches, red (2.5YR 4/8) clay; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, thick, platy structure that parts to moderate, fine, angular blocky; firm, sticky and plastic; few medium and fine roots; few fine pores; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3t—44 to 60 inches, red (2.5YR 4/6) and yellow (10YR 8/8) clay loam; moderate, coarse, angular blocky structure; friable, slightly sticky and slightly plastic; few medium and fine roots; common fine mica flakes; thin continuous clay films; reddish-brown (5YR 4/4) clay in root channels; very strongly acid; gradual, smooth boundary.

C—60 to 114 inches, red (2.5YR 5/8) sandy clay loam; massive; friable, slightly sticky and slightly plastic; few medium and fine roots; common fine mica flakes; very strongly acid.

The solum ranges from about 48 to 60 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon value is 4 or 5, and chroma is 2 to 4. This horizon is commonly fine sandy loam or sandy loam; however, some severely eroded Cecil soils that were mapped with severely eroded Turbeville soils have an Ap horizon of clay loam.

In the B1t horizon value is 4 or 5, and chroma is 6 to 8. In the B2t horizon hue generally is 2.5YR but ranges to 10R, value is 4 or 5, and chroma is 6 to 8. A few yellowish-brown mottles are present in many places.

Cecil soils are similar to soils in the Appling, Creedmoor, Helena, and Mayodan series. They have redder Bt horizons than Appling soils. They are better drained and have redder Bt horizons than Creedmoor and Helena soils, and they lack the gray colors in the lower horizons that are characteristic of those soils. They have redder Bt horizons and contain less sand than Mayodan soils.

Cecil soils are commonly near Appling, Ashlar, Bourne, Helena, and Pouncey soils. They have clayey Bt horizons which the Ashlar soils lack. They do not have the fragipan that is characteristic of Bourne soils. They are better drained than Pouncey soils.

Cecil fine sandy loam, 2 to 10 percent slopes, eroded (CeC2).—This soil is on the tops and sides of narrow ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Bourne, Helena, Turbeville, and Wedowee soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Cecil fine sandy loam, 10 to 25 percent slopes, eroded (CeD2).—This soil is on side slopes. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is clay loam.

Included with this soil in mapping are small areas of Turbeville and Wedowee soils.

Runoff is rapid on this soil, and the soil is slightly droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of the soil is wooded, but small areas are in cultivated crops or pasture. This soil has limited suitability for most crops commonly grown in the county. Capability unit IVe–1; woodland suitability group 3r1.

Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded (CfD3).—The Cecil and Turbeville soils in this unit are similar. They are on rolling uplands. About 40 percent of the total acreage of this mapping unit is Cecil clay loam, and about 30 percent is Turbeville clay loam. Some areas are entirely Cecil soil, some are entirely Turbeville soil, and others contain both soils. These soils have profiles similar to those described as representative of their respective series, but they have surface layers of clay loam.

Included with these soils in mapping are small areas of Appling soils on ridges and milder side slopes and strongly sloping to moderately steep Ashlar and Wedowee soils. Also included are small areas of gravelly soils. These inclusions make up about 30 percent of the mapping unit.

Runoff is medium to rapid on these soils, and they are somewhat droughty under prevailing climatic conditions. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover.

About one-fifth of the acreage of this unit is used for cultivated crops or pasture, and most of the rest of it is wooded. Capability unit IVe–2; woodland suitability group 4c1.

Chastain Series

The Chastain series consists of deep, poorly drained, nearly level soils that have a clayey subsoil. These soils formed in clayey and loamy alluvium on the flood plains.

In a representative profile the surface layer is dark-gray silt loam 5 inches thick. It has yellowish-red mottles. The subsoil is 54 inches thick. It is dark-gray clay that has strong-brown mottles. The substratum, at a depth of about 59 inches, extends to a depth of 65 inches or more. It is gray gravelly sandy clay loam.

Available water capacity is medium in Chastain soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 0 to 1 foot in winter and in spring. The soils are frequently flooded.

Representative profile of Chastain silt loam, one-eighth mile west of Chickahominy River, 1 mile east of Wilkerson Road near Chickahominy Bluffs subdivision:

O1—½ inch to 0, partly decomposed pine needles, leaves, and twigs.

A1—0 to 5 inches, dark-gray (10YR 4/1) silt loam; common medium, prominent yellowish-red (5YR 4/8) mottles; moderate, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; few small pebbles; very strongly acid; abrupt, smooth boundary.

B2g—5 to 59 inches, dark-gray (10YR 4/1) clay; common medium, prominent, strong-brown (7.5YR 5/8) mottles; moderate, coarse, subangular blocky structure; firm, sticky and plastic; occasional pockets of white sand; many fine roots; few fine pores; few flakes of mica; few small pebbles; very strongly acid; clear, smooth boundary.

IICg—59 to 65 inches, gray (10YR 5/1) gravelly sandy clay loam; massive; few fine flakes of mica; very strongly acid.

The solum ranges from about 40 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Fine mica flakes are few to common throughout the solum. The solum includes 1 to 5 percent, by volume, of small rounded pebbles, and the substratum includes as much as 20 to 35 percent of small rounded pebbles.

In the A horizon value is 4 or 5, and chroma is 1 to 3. The A horizon is commonly silt loam but ranges to loam and very fine sandy loam.

In the Bg horizon hue is 10YR, 2.5Y, and N, value is 4 to 6, and chroma is 0 to 2. The Bg horizon has strong-brown, brownish-yellow, or yellowish-brown mottles.

The C horizon is commonly stratified sand, silt, and clay that has gravel in many places.

Chastain soils are similar to soils in the Chewacla, Kinston, and Roanoke series. They are more poorly drained and have a grayer subsoil than Chewacla soils. They have a more clayey subsoil than Kinston soils. They do not have the Bt horizon characteristic of Roanoke soils.

Chastain soils are near Altavista, Chewacla, Mantachie, Pamunkey, and Roanoke soils. They are more poorly drained than Altavista, Mantachie, and Pamunkey soils.

Chastain silt loam (Cg).—This nearly level soil is on bottom lands along streams. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Chewacla and Mantachie soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is difficult to till and is cloddy if tilled when it is too wet or too dry. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but some small areas are in pasture. Capability unit IVw–1; woodland suitability group 3w2.

Chewacla Series

The Chewacla series consists of deep, poorly drained, nearly level soils that have a loamy subsoil. These soils formed in loamy alluvium.

In a representative profile the surface layer is dark-brown silt loam 10 inches thick. The subsoil is 34 inches thick. It is brown silt loam that has light brownish-gray mottles below a depth of about 16 inches. The substratum, at a depth of 44 inches, extends to a depth of 95 inches or more. It is dark yellowish-brown loam that has many gray mottles.

Available water capacity is high in Chewacla soils. Reaction is strongly acid to medium acid in the subsoil, except where the soil is limed. Permeability is moderate. A seasonal high water table is at a depth of 1½ to 2½ feet in winter and in spring. The soils are frequently flooded.

Representative profile of Chewacla silt loam, 1⅛ mile southeast of Lorraine, three-eighths mile south of Mooreland and the C&O Railroad, between Big Tuckahoe Creek and the James River:

Ap—0 to 10 inches, dark-brown (7.5YR 4/2) silt loam; moderate, fine, granular structure; friable, nonsticky and nonplastic; many fine roots; common fine mica flakes; strongly acid; abrupt, smooth boundary.

B1—10 to 16 inches, brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; common fine roots; few fine pores; common fine mica flakes; strongly acid; gradual, smooth boundary.

B2—16 to 44 inches, brown (10YR 4/3) silt loam; many medium, distinct, light brownish-gray (10YR 6/2) mottles; light brownish-gray (10YR 6/2) coatings on ped surfaces; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; few fine roots; common fine mica flakes; few concretions; strongly acid; abrupt, smooth boundary.

C—44 to 95 inches, dark yellowish-brown (10YR 4/4) loam; many medium, distinct, gray (10YR 5/1) mottles; massive; friable, nonsticky and nonplastic; common fine mica flakes; strongly acid.

The solum ranges from about 38 to 50 inches in thickness. Depth to bedrock is more than 5 feet. Fine mica flakes are few to common throughout the solum.

In the Ap horizon hue is 7.5YR and 10YR, value is 3 to 5, and chroma is 2 to 4. The A horizon is commonly silt loam but ranges to loam.

In the B horizon hue is 10YR and 7.5YR, value is 4 or 5, and chroma is 3 to 5. Mottles of chroma 2 are present below a depth of 16 inches and increase with increasing depth. Ped surfaces are often chroma 2 or less. The B horizon is commonly silt loam but ranges to loam and light silty clay loam.

The C horizon is dark yellowish brown or yellowish brown and has gray mottles. It ranges from loam and silty clay loam to loamy sand and sand.

Chewacla soils are similar to soils in the Chastain, Riverview, State, and Toccoa series. They are less well drained than Chastain, Riverview, and State soils, which do not have mottles of chroma 2 in their subsoils. In addition, State soils have a Bt horizon. Chewacla soils are less well drained than Toccoa soils and have a B horizon that has mottles of chroma 2, which is not characteristic of Toccoa soils.

Chewacla soils are near Altavista, Chastain, Pamunkey, Riverview, and Toccoa soils. They do not have the Bt horizon that is characteristic of Altavista and Pamunkey soils and are less well drained than Pamunkey soils.

Chewacla silt loam (Ch).—This nearly level soil is on broad bottom lands along the larger streams. It has the profile described as representative of the series. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of well-drained Riverview and Toccoa soils in slightly elevated areas. Also included are small areas of sandy and clayey soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. Drainage is desirable if the soil is used for farming. The hazard of erosion is slight.

Most of the acreage of this soil is used for cultivated crops or pasture. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIIw–3; woodland suitability group 1w1.

Chewacla silt loam, clayey substratum (Ck).—This nearly level soil is on broad, low-lying flood plains along the larger streams. Its profile differs from the one described as representative of the series by having layers of light silty clay or clay loam in the subsoil. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of well-drained Riverview and Congaree soils that are in slightly elevated areas and small areas of poorly drained Roanoke soils in slight depressions. Also included are small areas of sandy and gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, and small areas are used for cultivated crops or pasture. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIIw–3; woodland suitability group 1w1.

Chewacla and Riverview soils (Cm).—The Chewacla and Riverview soils in this mapping unit are similar. They are on flood plains throughout the county, mostly along numerous small streams but also along larger streams. About 40 percent of the total acreage of this mapping unit is Chewacla soils, and about 35 percent is Riverview soils. Some areas are entirely Chewacla soil, some are entirely Riverview soil, and others con-

tain both soils. These soils have profiles similar to those described as representative of their respective series. Surface textures are dominantly loam or silt loam.

Included with these soils in mapping are small areas of Altavista, Chastain, Colfax, Pouncey, Roanoke, and Toccoa soils. Also included are small areas of gravelly soils and small areas of well-drained loamy sands. These included areas make up about 25 percent of the mapping unit.

Runoff is slow on these soils, and the soils are not droughty under prevailing climatic conditions. They are friable and are easily tilled. The hazard of erosion is slight. Drainage is desirable if the soils are used for farming.

About three-fourths of the acreage of this unit is wooded, and most of the rest is used for cultivated crops or pasture. These soils are suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIIw–3; woodland suitability group 1w1.

Colfax Series

The Colfax series consists of deep, somewhat poorly drained, nearly level to gently sloping soils that have a fragipan at a depth of 25 to 40 inches. These soils formed in material weathered from granite and gneiss.

In a representative profile the surface layer is fine sandy loam about 6 inches thick. It is dark gray in the upper part and light brownish gray and grayish brown in the lower part. The subsoil above the fragipan is yellowish-brown and light brownish-gray sandy clay loam 24 inches thick. The fragipan, at a depth of 30 inches, extends to a depth of 54 inches or more and is very brittle and compact in place. The upper part of the fragipan is strong-brown and light brownish-gray light sandy clay loam. The lower part of the fragipan is white sandy loam.

Available water capacity is low in Colfax soils. Reaction is very strongly acid in the subsoil. Permeability in the subsoil above the fragipan is moderate, but permeability in the fragipan is slow. Perched water tables are above the fragipan in wet seasons. The soils are frequently flooded.

Representative profile of Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes, in West Broad Street Gardens at Bunche Street and Hawkins Road, in an urban area at the eastern edge of the city of Richmond:

O1—2 inches to 0, partly decomposed leaves, needle, cones and twigs.

A1—0 to 3 inches, dark-gray (10YR 4/1) fine sandy loam; moderate, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; very strongly acid; clear, smooth boundary.

A2—3 to 6 inches, light brownish-gray (2.5Y 6/2) and grayish-brown (2.5Y 5/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; few small rounded pebbles; very strongly acid; clear, smooth boundary.

B2t–6 to 30 inches, yellowish-brown (10YR 5/8) and light brownish-gray (2.5Y 6/2) sandy clay loam; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; common medium and fine roots; common fine pores; few small rounded pebbles; thin, patchy clay films; very strongly acid; gradual, smooth boundary.

Bx1–30 to 48 inches, strong-brown (7.5YR 5/6) and light brownish-gray (2.5Y 6/2) sandy clay loam; weak, thick, platy structure; friable, nonsticky and nonplastic; extremely brittle and compact in place; common fine vesicular pores; few small rounded pepples; few thin patchy clay films; very strongly acid; clear, smooth boundary.

Bx2—48 to 54 inches, white (10YR 8/1) sandy loam; massive; friable, nonsticky and nonplastic; extremely brittle and compact in place; very strongly acid.

The solum ranges from about 40 to 54 inches in thickness. Depth to the fragipan ranges from 25 to 40 inches. Depth to bedrock is more than 4 feet.

The A1 horizon is dark gray or gray, and hue is 10YR, 2.4Y, or N. In the A2 horizon hue is 2.5Y, value is 5 or 6, and chroma is 2 to 4. The A horizon is fine sandy loam or sandy loam.

In the Bt horizon hue is 10YR and 2.5Y, value is 5 or 6, and chroma is 4 to 8. Mottles of chroma 2 or less are in the upper 10 inches of the Bt horizon. Some Bt horizons are a mixture of colors that have chroma 2 or less and colors that have higher chroma. The Bt horizon is commonly light sandy clay loam but ranges to heavy loam. In the Bx1 horizon hue is a mottled 7.5YR, 10YR, and 2.5Y, value is 5 or 6, and chroma is 2 to 6. The Bx2 horizons are commonly white or light gray with yellowish-brown mottles in many places. The Bx horizon ranges from sandy clay loam to sandy loam.

Colfax soils are similar to soils of the Bourne, Creedmoor, and Pouncey series. They are more poorly drained than Bourne soils and have mottles of chroma 2 in the upper 10 inches of the Bt horizon, and Bourne soils do not. They have less clayey Bt horizons that Pouncey soils, which have gray clay Bt horizons, and they have a fragipan, which is not characteristic of Creedmoor and Pouncey soils.

Colfax soils commonly are near Appling, Ashlar, Bourne, Creedmoor, Helena, and Pouncey soils. They have a fragipan which Appling, Ashlar, and Helena soils lack.

Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes (CoB).—This soil is on upland flats, along drainageways, and around the heads of drainageways.

Included with this soil in mapping are small areas of somewhat poorly drained Orange soils with clayey subsoils and poorly drained Pouncey soils. Also included are small areas of soils that have a heavy sandy loam subsoil above the fragipan.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight to severe if the soil is without plant cover. A seasonal high water table is at a depth of 1 to 1½ feet. Drainage is desirable if the soil is used for farming. Slightly concave areas are ponded during wet seasons.

Most of the acreage of this soil is wooded, but some small areas are used for pasture. It has limited suitability for most crops commonly grown in the county, except for deep-rooted crops and for those crops that are sensitive to excess moisture. Capability unit IIIw–2; woodland suitability group 2w1.

Coxville Series

The Coxville series consists of deep, poorly drained,

nearly level soils that have a thick, dominantly clayey subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is very dark gray silt loam 8 inches thick. The subsoil is about 85 inches thick or more. It is gray clay that has yellowish-brown and strong-brown mottles.

Available water capacity is medium in Coxville soils. Reaction is very strongly acid in the subsoil, and permeability is moderately slow. A seasonal high watertable is at a depth of 0 to 1 foot for much of the year, and the soils are very frequently flooded.

Representative profile of Coxville silt loam, one-half mile south of the junction of Charles City Road and the C&O Railroad, 50 feet west of Monahan Road:

O1—1 inch to 0, partly decomposed leaves, pine needles, and twigs.

A1—0 to 8 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable, slightly sticky and nonplastic; many medium and fine roots; few fine pores; very strongly acid; clear, smooth boundary.

B21tg—8 to 26 inches, gray (10YR 5/1) clay; few medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, coarse, angular blocky structure; firm, sticky and plastic; common medium and fine roots; few large, medium, and fine pores; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B22tg—26 to 44 inches, gray (10YR 5/1) clay; common medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, coarse, prismatic structure parting to moderate, medium, angular blocky; firm; sticky and plastic; common medium and fine roots; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3tg—44 to 93 inches, gray (10YR 5/1) clay; many medium, distinct, strong-brown mottles; weak, coarse, prismatic structure and moderate, coarse, angular blocky; firm, sticky and plastic; common medium and fine roots in upper part; few medium and fine pores; thin continuous clay films; very strongly acid; gradual, wavy boundary.

The solum ranges from about 81 to 107 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR to 5Y and N, value is 2 or 3, and chroma is 0 and 1. The A horizon is commonly silt loam but ranges to loam.

In the Bt horibon hue is 10YR to 5Y and N, value is 4 to 6, and chroma is 0 and 1. Yellowish-brown and strong-brown mottles are present. The Bt horizon is commonly clay but ranges to heavy clay loam.

Coxville soils are similar to soils in the Forestdale and Rains series. They are less sticky and less plastic than Forestdale soils. They have more than 35 percent clay in the top 20 inches of the Bt horizon, which is not characteristic of Rains soils.

Coxville soils are near Atlee, Duplin, Lynchburg, and Rains soils. They are more clayey than Atlee soils. They are less well drained than Duplin soils and are gray throughout the solum. They have more clayey Bt horizons and are less well drained than Lynchburg soils.

Coxville silt loam (Cp).—This nearly level soil is on upland flats and in upland depressions. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of moderately well drained Atlee soils and poorly drained Rains soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight. The soil is frequently flooded.

Most of the acreage of this soil is wooded, but some small areas are in pasture. Capability unit IVw–1; woodland suitability group 3w2.

Creedmoor Series

The Creedmoor series consists of deep, moderately well drained, gently sloping to sloping soils that have a dominantly clayey subsoil. These soils formed in materials weathered from sandstone and shale.

In a representative profile the surface layer is light yellowish-brown sandy loam 10 inches thick. The subsoil is 38 inches thick. The upper 5 inches is yellowish-brown sandy clay loam, the next 5 inches is yellowish-brown clay loam that has yellowish-red mottles, and the next 6 inches is red and light brownish-gray clay. The lower 22 inches is gray clay. The substratum, at a depth of 48 inches, extends to a depth of 78 inches or more. It is weathered sandstone.

Available water capacity is medium in Creedmoor soils. Reaction is very strongly acid in the subsoil, and permeability is very slow. A seasonal high water table is at a depth of 1½ to 2½ feet.

Representative profile of Creedmoor sandy loam, 2 to 6 percent slopes, 2 miles west of Short Pump, between Gayton Road and Little Tuckahoe Creek:

O1—2 inches to 0, partly decomposed pine needles, cones, leaves, and twigs.

Ap—0 to 10 inches, light yellowish-brown (10YR 6/4) sandy loam; moderate, fine, granular structure; very friable, nonsticky and nonplastic; many coarse, medium, and fine roots; very strongly acid; abrupt, smooth boundary.

B1t—10 to 15 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common medium and fine roots; thin patchy clay films; very strongly acid; clear, smooth boundary.

B21t–15 to 20 inches, yellowish-brown (10YR 5/6) clay loam; few medium, distinct, yellowish-red (5YR 5/8) mottles; weak, medium, subangular blocky structure; friable, sticky and slightly plastic; few medium and fine roots; few fine pores; few small rounded pebbles; few fine mica flakes; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22t—20 to 26 inches, red (10R 4/8) and light brownish-gray (10YR 6/2) clay; weak, medium, angular blocky structure; very firm, sticky and plastic; few medium and fine pores; few fine rounded pebbles; few fine mica flakes; thin patchy clay films; very strongly acid; clear, wavy boundary.

B3t—26 to 48 inches, gray (10YR 6/1) clay; weak, coarse, angular blocky structure; very firm, sticky and plastic; few fine roots; few strong-brown (7.5YR 5/8) weathered sandstone fragments; few fine mica flakes; thin patchy clay films; very strongly acid; clear, wavy boundary.

C—48 to 78 inches, brown, strongly weathered sandstone; crushes easily to sandy loam; few fine mica flakes; very strongly acid.

The solum ranges from about 41 to 56 inches in thickness. Depth to bedrock is more than 5 feet.

In the Ap horizon hue is 10YR and 2.5Y, value is 4 to 6, and chroma is 2 to 4. The Ap horizon is commonly sandy loam but ranges to fine sandy loam.

In the upper part of the Bt horizon hue is 10YR and 7.5YR, value is 5 or 6, and chroma is 4 to 8. Yellowish-red mottles often are below a depth of about 15 inches. The Bt horizon ranges from sandy clay loam and clay loam to light sandy clay. The B22t horizon ranges from light yel-

lowish brown, light brownish gray, and yellowish brown to red and has gray mottles. The B3t horizon is commonly gray and has strong-brown and yellowish-brown mottles. It has some weathered sandstone fragments.

The C horizon is commonly brown, strongly weathered sandstone.

Creedmoor soils are similar to soils of the Cecil, Colfax, and Mayodan series. They are less well drained than Cecil soils and have a gray subsoil color that is not characteristic of Cecil soils. They do not have the fragipan that is characteristic of Colfax soils. They are less well drained than the Mayodan soils, and they have gray mottles in the Bt horizon, and Mayodan soils do not.

Creedmoor soils are near Bourne, Colfax, Mayodan, and Turbeville soils. They do not have the fragipan that is characteristic of Bourne soils. They are less well drained than Turbeville soils, which have red Bt horizons and do not have the gray mottles that are characteristic of Creedmoor soils.

Creedmoor sandy loam, 2 to 6 percent slopes (CvB).—This soil is on rather broad, weakly convex ridgetops. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Colfax soils in nearly level areas and small areas of well-drained Mayodan soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops and pasture. It is suited to most crops commonly grown in the county, except for deep-rooted crops and those that are sensitive to excess water. Capability unit IIe–3; woodland suitability group 4c1.

Creedmoor sandy loam, 2 to 6 percent slopes, eroded (CvB2).—This soil is on convex ridgetops and side slopes. It has a thinner surface layer than the one in the profile described as representative of the series. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of somewhat poorly drained Colfax soils and small areas of well-drained Mayodan soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops and pasture. It is suited to most crops commonly grown in the county, except for deep-rooted crops and for those that are sensitive to excess moisture. Capability unit IIIe–3; woodland suitability group 4c1.

Creedmoor sandy loam, 6 to 10 percent slopes, eroded (CvC2).—This soil is on side slopes. It has a thinner surface layer than the one in the profile described as representative of the series. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of clayey soils and small wet areas along the basis of slopes.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops and pasture. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those that are sensitive to excess moisture. Capability unit IVe–3; woodland suitability group 4c1.

Duplin Series

The Duplin series consists of deep, moderately well drained, nearly level to sloping soils that have a thick, dominantly clayey subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is dominantly light yellowish-brown very fine sandy loam 7 inches thick. The subsoil is about 103 inches thick. The upper 12 inches is mainly strong-brown clay loam. The next 24 inches is reddish-yellow clay that has light-gray, strong-brown, and red mottles. The lower 67 inches of the subsoil is light-gray and yellow clay that has red mottles. The substratum, at a depth of 110 inches, extends to a depth of 128 inches or more. It is strong-brown light sandy clay loam that has light-gray and red mottles.

Available water capacity is medium in Duplin soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 1½ to 2½ feet.

Representative profile of Duplin very fine sandy loam, 6 to 10 percent slopes, eroded, seven-eighths mile west of Meadow Road and 100 feet north of Interstate Route 64:

O1—½ inch to 0, partly decomposed leaves and twigs.

A1—0 to 1 inch, very dark gray (10YR 3/1) very fine sandy loam; moderate, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; very strongly acid; abrupt, smooth boundary.

A2—1 to 7 inches, light yellowish-brown (2.5Y 6/4) very fine sandy loam; moderate, fine, granular structure; friable, nonsticky and nonplastic; many medium and fine roots; very strongly acid; clear, smooth boundary.

B1t—7 to 10 inches, yellow (10YR 7/6) light sandy clay loam; weak, subangular blocky structure; friable, slightly sticky and nonplastic; many medium and fine roots; few fine pores; few thin patchy clay films; very strongly acid; clear, smooth boundary.

B21t—10 to 19 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, subangular blocky structure; friable, sticky and slightly plastic; few fine roots; few fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22t—19 to 43 inches, reddish-yellow (7.5YR 6/6) clay; common medium, distinct, light-gray (10YR 7/1)

and strong-brown (7.5YR 5/6) mottles and few fine, prominent, red (10R 4/8) mottles; moderate, thick, platy structure; firm, sticky and plastic; few fine roots; few fine pores; thin patchy clay films; very strongly acid; gradual, smooth boundary.

B3t—43 to 110 inches, mottled, light-gray (N 7/0) and yellow (10YR 7/6) clay; few fine, prominent, red (10R 4/8) mottles; weak, coarse, prismatic structure parting to weak, medium, angular blocky; firm, sticky and plastic; few fine roots; thin patchy clay films; very strongly acid; gradual, smooth boundary.

C—110 to 128 inches, strong-brown (7.5YR 5/8) light sandy clay loam; few fine, prominent, red (2.5YR 4/8) mottles; massive; friable, nonsticky and nonplastic; lenses of light-gray (5Y 7/1) clay; very strongly acid.

The solum is more than 50 inches in thickness. Depth to bedrock is more than 5 feet.

In the A1 horizon hue is 10YR and 2.5Y, value is 3 or 4, and chroma is 1 or 2. In the A2 horizon hue is 2.5Y and 10YR, value is 4 to 6, and chroma is 2 to 4. The A2 horizon ranges from very fine sandy loam to silt loam and is clay loam in severely eroded areas.

In the Blt horizon hue is 10YR and 2.5Y, value is 5 to 7, and chroma is 4 to 6. In the Bt horizon hue is 7.5YR and 10YR, value is 4 to 8, and chroma is 3 or more. Gray mottles of chroma 2 or less are within the upper 24 inches of the Bt horizon. Strong-brown and red mottles commonly are in the Bt horizon at a depth of 19 inches or more.

The C horizon ranges from light sandy clay loam to clay.

Duplin soils are similar to soils in the Angie, Caroline Faceville, Lenoir, and Norfolk series. They have kaolinitic mineralogy and contain less than 30 percent silt in the upper part of the subsoil. Angie soils have mixed mineralogy and contain more than 30 percent silt in the upper part of the subsoil. They have mottles of chroma 2 or less in the upper 24 inches of the Bt horizon, and Caroline, Faceville, and Norfolk soils do not. They are better drained than Lenoir soils.

Duplin soils are near Atlee, Caroline, Coxville, Lenoir, and Rains soils. They do not have the weak fragipan that is characteristic of Atlee soils. They are better drained than Coxville and Rains soils and do not have the gray Bt horizon that is characteristic of these soils.

Duplin very fine sandy loam, 2 to 6 percent slopes, eroded (DuB2).—This soil is on broad, weakly convex ridges and side slopes. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of well-drained Caroline, Norfolk, and Ruston soils and small areas of moderately well drained Atlee soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About one-third of the acreage of this soil is used for cultivated crops and pasture, and most of the rest of it is wooded. This soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIe–2; woodland suitability group 3o1.

Duplin very fine sandy loam, 6 to 10 percent slopes, eroded (DuC2).—This soil is on side slopes. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Caroline soils. Also included are small wet areas along the lower sections of some slopes.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About one-fourth of the acreage of this soil is used for cultivated crops and pasture, and most of the rest of it is wooded. This soil is suited to most crops commonly grown in the county, except for alfalfa, which is short lived because of excess wetness. Capability unit IIIe–2; woodland suitability group 3o1.

Duplin very fine sandy loam, 10 to 15 percent slopes, eroded (DuD2).—This soil is on side slopes. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of well-drained Caroline soils and areas of Ochrepts and Udults. Also included are small wet areas along the lower sections of slopes.

Runoff is rapid on this soil, and the soil is not droughty under prevailing climatic conditions. A seasonal high water table is not as persistent as the seasonal water tables in less sloping Duplin soils. The soil is friable and is easily tilled. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops and pasture. This soil has a limited suitability for most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IVe–3; woodland suitability group 3o1.

Duplin silt loam, 0 to 2 percent slopes (DvA).—This soil is on broad ridges. It has a thicker surface layer than the one in the profile described as representative of the series. The silt loam surface layer ranges from 10 to 12 inches in thickness.

Included with this soil in mapping are small areas of moderately well drained Atlee soils and small areas of well-drained Norfolk soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming. Small depressions pond in wet seasons.

About half of the acreage of this soil is used for cultivated crops, and most of the other half is wooded. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIw–2; woodland suitability group 3o1.

Duplin clay loam, 2 to 10 percent slopes, severely eroded (DwC3).—This soil is on narrow ridges and side slopes. The clay loam plow layer is mostly subsoil material. In some less severely eroded places, the surface layer is sandy clay loam or very fine sandy loam. This soil has a profile that is somewhat thinner than the one described as representative of the series.

Included with this soil in mapping are small areas of well-drained Caroline and Norfolk soils. Also included are small gullied areas.

Runoff is medium to rapid on this soil, and the soil is somewhat droughty under prevailing climatic conditions. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. The soil is cloddy if it is tilled when it is too wet or too dry. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops and pasture. This soil has limited suitability for most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IVe–2; woodland suitability group 4c1.

Faceville Series

The Faceville series consists of deep, well-drained, nearly level to gently sloping soils that have a thick loamy to clayey subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is brown fine sandy loam 8 inches thick. The subsoil is 87 inches thick. The upper 5 inches is yellowish-red and strong-brown heavy fine sandy loam, the next 14 inches is yellowish-red light clay loam, and the lower 68 inches is red heavy clay loam that has yellowish-brown mottles. The substratum, at a depth of 95 inches, extends to a depth of 126 inches or more. It is red, brownish-yellow, and gray heavy clay loam.

Available water capacity is high in Faceville soils. Reaction is very strongly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Faceville fine sandy loam, 0 to 2 percent slopes, 200 feet north of Laburnum Avenue, 300 feet west of Fenwick Street, in an urban area at the eastern edge of the city of Richmond:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

Ap—0 to 8 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common coarse, medium, and fine roots; very strongly acid; abrupt, smooth boundary.

B1—8 to 13 inches, yellowish-red (5YR 5/8) and strong-brown (7.5YR 5/8) heavy fine sandy loam; weak, fine, subangular blocky structure; friable, slightly sticky and nonplastic; common medium and fine roots; few fine pores; sand grains coated and bridged with clay; very strongly acid; clear smooth boundary.

B21t—13 to 19 inches, yellowish-red (5YR 4/8) light clay loam; weak, medium, subangular blocky structure; medium and fine roots; few fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22t—19 to 70 inches, red (2.5YR 4/6) heavy clay loam; few medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; firm, sticky and plastic; few medium and fine roots; few fine pores; thin continuous clay films; strongly acid; gradual, smooth boundary.

B3t–70 to 95 inches, red (2.5YR 4/6) heavy clay loam; many medium, distinct, yellowish-brown (10YR 5/6) mottles; firm, sticky and plastic; few medium and fine roots; few small rounded pebbles; thin patchy clay films; strongly acid; gradual, smooth boundary.

C—95 to 126 inches, red (2.5YR 4/8), brownish-yellow (10YR 6/6), and light-gray (N 7/0) heavy clay loam; massive; firm, sticky and plastic; strongly acid.

The solum ranges from about 80 to 108 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR, value is 4 or 5, and chroma is 2 to 4. The A horizon is commonly fine sandy loam but ranges to sandy loam.

In the B1 horizon hue is 5YR and 7.5YR, value is 4 or 5, and chroma is 4 to 8. In the Bt horizons hues are 5YR or 2.5YR, value is 4 or 5, and chroma is 6 to 8. Redness increases with increasing depth. The Bt horizon is commonly heavy clay loam but ranges to clay and sandy clay.

The C horizon is red, brownish-yellow, and gray heavy clay loam to clay and sandy clay.

Faceville soils are similar to soils in the Caroline, Duplin, Norfolk, Ruston, and Turbeville series. They have redder lower Bt horizons than Caroline soils. They do not have mottles of chroma 2 or less that are characteristic of Duplin soils. They have more clayey Bt horizons than Norfolk and Ruston soils. They are not so dark red in the lower Bt horizon as Tuberville soils.

Faceville soils are near Atlee, Norfolk, Ruston, and Turbeville soils. They do not have the weak fragipan that is characteristic of Atlee soils.

Faceville fine sandy loam, 0 to 2 percent slopes (FaA).—This soil is on broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Norfolk and Ruston soils and small areas of Atlee soils in slight depressions.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half the acreage of this soil is used for cultivated crops and pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Faceville fine sandy loam, 2 to 6 percent slopes, eroded (FaB2).—This soil is on broad ridges. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is heavy fine sandy loam.

Included with this soil in mapping are small areas of Caroline and Ruston soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Fluvaquents

Fluvaquents (FL) consists of low-lying areas of mixed alluvium that are waterlogged or covered by fresh water, except in extended dry periods. The alluvium ranges from sand to clay and is commonly un-

derlain by stratified sand and gravel. The surface layer is commonly gray or dark gray. The substratum is strongly gleyed and is gray, greenish gray, or bluish gray. A mat of partly decayed organic material is on the surface in many places.

Fluvaquents are along the larger drainageways and streams. They are often wooded but contain areas of open water and areas covered by reeds, cattails, arrowleaf, and other aquatic plants. Capability unit VIIw–1; woodland suitability group unclassified.

Forestdale Series

The Forestdale series consists of deep, poorly drained, nearly level soils that have a clayey subsoil. These soils formed in alluvium on terraces.

In a representative profile the surface layer is very dark gray silt loam 7 inches thick. The subsoil is 41 inches thick and is very dark gray and gray clay that has dark-brown mottles. The substratum, at a depth of 48 inches, extends to a depth of 87 inches or more. It is gray gravelly sand and greenish-gray sandy clay loam.

Available water capacity is medium in Forestdale soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability is very slow. A seasonal high water table is at a depth of 0 to 1 foot, and the soils are frequently flooded.

Representative profile of Forestdale silt loam, three-fourths mile northeast of Meadow Road, three-fourths mile north of Southern Railroad, one-half mile west of the Chickahominy River:

O1—½ inch to 0, partly decomposed leaves and twigs.
A1—0 to 7 inches, very dark gray (10YR 3/1) silt loam, gray (10YR 6/1) when dry; moderate, fine, granular structure; friable, slightly sticky and nonplastic; many medium and fine roots; strongly acid; clear, smooth boundary.
B2tg—7 to 42 inches, very dark gray (N 3/0) clay, gray (10YR 6/1) when dry; common medium, distinct, dark-brown (7.5YR 4/4) mottles; moderate, coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, very sticky and very plastic; many fine roots; few fine rounded pebbles; thin continuous clay films; strongly acid; clear, smooth boundary.
B3tg—42 to 48 inches, gray (5Y 5/1) clay; weak, coarse, prismatic structure; very firm, very sticky and very plastic; common fine roots; strongly acid; clear, smooth boundary.
IIClg—48 to 77 inches, gray (5Y 6/1) gravelly sand; single grained; very strongly acid; clear, smooth boundary.
IIIC2g—77 to 87 inches, greenish-gray (5GY 6/1) sandy clay loam; massive; friable, sticky and nonplastic; very strongly acid.

The solum ranges from about 40 to 58 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR and 2.5Y, value is 3 or 4, and chroma is 1 or 2. The A horizon is silt loam or heavy silt loam.

In the Bt horizon hue is 10YR to 5Y and N, value is 3 to 5, and chroma is 0 to 2.

The C horizon is gray to greenish gray and ranges from gravelly sand to clay.

Forestdale soils in this survey area have more clay in the lower part of the subsoil than Forestdale soils in other survey areas. This difference, however, does not alter their usefulness or management.

Forestdale soils are similar to soils in the Coxville, Portsmouth, and Roanoke series. They have montmorillonitic mineralogy, while Coxville soils have kaolinitic mineralogy, and Roanoke soils have mixed mineralogy. They contain more clay in the Bt horizons than Portsmouth soils.

Forestdale soils commonly are near Altavista, Kalmia, and Portsmouth soils. They have more clayey Bt horizons and are not as well drained as Altavista and Kalmia soils.

Forestdale silt loam (Fo).—This nearly level soil is on small, low-lying terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Myatt and Portsmouth soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. Ponding occurs during wet seasons.

Most of the acreage of this soil is wooded, but some small areas are in pasture. This soil has a very limited suitability to most crops commonly grown in the county. Capability unit IVw–1; woodland suitability group 1w2.

Helena Series

The Helena series consists of deep, moderately well drained, gently sloping to sloping soils that have a clayey subsoil. These soils formed in material weathered from granite, gneiss, and schist.

In a representative profile the surface layer is grayish-brown fine sandy loam 10 inches thick. The subsoil is 30 inches thick. The upper 18 inches is yellowish-brown clay, and the lower 12 inches is mixed brownish-yellow and strong-brown clay that has gray mottles. The substratum, at a depth of 40 inches, extends to a depth of 100 inches or more. It is brownish-yellow and strong-brown clay loam that has veins of gray clay.

Available water capacity is medium in Helena soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 2 to 3 feet in wet seasons.

Representative profile of Helena fine sandy loam, 2 to 6 percent slopes, one-fourth mile northeast of Short Pump fire tower and 100 feet south of Interstate Route 64:

O1—1 inch to 0, partly decomposed pine needles, cones, twigs, and leaves.
Ap—0 to 10 inches, grayish-brown (2.5Y 5/2) fine sandy loam; weak, fine, granular structure; very friable, slightly sticky and nonplastic; common medium and fine roots; few rounded and angular pebbles; very strongly acid; gradual, smooth boundary.
B21t—10 to 28 inches, yellowish-brown (10YR 5/8) clay; moderate, medium, angular blocky structure; firm, sticky and plastic; few medium and fine roots; few fine pores; thin continuous clay films; very strongly acid; gradual, smooth boundary.
B22t—28 to 40 inches, brownish-yellow (10YR 6/8) and strong-brown (7.5YR 5/8) clay; few fine, distinct, gray (5Y 5/1) and few, medium, prominent, red (10R 5/8) mottles; moderate, coarse, angular blocky structure; very firm, sticky and plastic; few medium and fine roots; thin continuous clay films; very strongly acid; gradual, wavy boundary.
C—40 to 100 inches, brownish-yellow (10YR 6/8) and strong-brown (7.5YR 5/8) clay loam; massive; friable slightly sticky and slightly plastic; veins of gray (5Y 5/1) clay; very strongly acid.

The solum ranges from 33 to 48 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 2.5Y and 10YR, value is 5 and occasionally 6, and chroma is 1 to 3. The A horizon is commonly fine sandy loam but ranges to loam.

In the Bt horizon hue is 10YR and 7.5YR, value is 5 or 6, and chroma is 6 to 8. Mottles of chroma 2 or less are in the upper 24 inches of the Bt horizon. A few red mottles are in the lower part of the Bt horizon in many places.

The C horizon is commonly brownish-yellow, yellowish-brown, and strong-brown clay loam but ranges to sandy loam. Veins of gray clay or clay loam are in the upper part in many places.

Helena soils are similar to soils in the Appling, Cecil, Creedmoor, and Mayodan series. They have low-chroma mottles in the upper 24 inches of the Bt horizons, which are not characteristic of Appling and Cecil soils. They contain less exchangeable aluminum than Creedmoor soils. They have a yellower Bt horizon that contains low-chroma mottles in the upper 24 inches that is not characteristic of Mayodan soils.

Helena soils commonly are near Appling, Ashlar, Bourne, Cecil, Colfax, and Pouncey soils. They are more clayey and less well drained than Ashlar soils. They do not have the fragipan that is characteristic of Bourne and Colfax soils. They are better drained than Pouncey soils.

Helena fine sandy loam, 2 to 6 percent slopes (HeB). This soil is on somewhat broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Appling soils and moderately well drained Bourne soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About one-fourth of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those that are sensitive to excess wetness. Capability unit IIe–3; woodland suitability group 4c1.

Helena fine sandy loam, 2 to 6 percent slopes, eroded (HeB2).—This soil is on somewhat narrow ridges and some side slopes. It has a thinner surface layer than the one in the profile described as representative of the series. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam or clay loam.

Included with this soil in mapping are small areas of well-drained Appling soils and moderately well drained Bourne soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops. Drainage is desirable if the soil is used for farming.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county, except for deep-rooted crops and for those that are sensitive to excess wetness. Capability unit IIIe–3; woodland suitability group 4c1.

Helena fine sandy loam, 6 to 15 percent slopes, eroded (HeC2).—This soil is on side slopes. It has a thinner surface layer than the one in the profile described as representative of the series. In some areas, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam or clay loam.

Included with this soil in mapping are small areas of well-drained Appling soils. Also included are small areas of gravelly soils.

Runoff is rapid on this soil, and the soil is somewhat droughty under prevailing climatic conditions. The hazard of further erosion is severe if the soil is disturbed and left without plant cover.

Most of the acreage of this soil is wooded. Capability unit IVe–3; woodland suitability group 4c1.

Hydraquents

Hydraquents (HS) consists of low-lying areas of mixed alluvium along the James River. These areas are covered periodically by tidal waters. The mixed alluvium is commonly composed of layers of sandy, loamy, clayey, and mucky material. The surface layer is usually gray to black and is often mucky. The substratum is gray, greenish gray, or bluish gray. Layers of dark-gray or black mucky material are at various depths.

Hydraquents are continually waterlogged. Low areas are covered by tidal waters daily; higher areas are covered only by unusually high tides or storm tides. Hydraquents commonly have a cover of reeds, cattails, arrowleaf, rushes, and other aquatic plants. Higher areas often support a few stunted trees. Capability unit VIIw–1; woodland suitability group unclassified.

Kalmia Series

The Kalmia series consists of deep, well-drained, nearly level to sloping soils that have a loamy subsoil. These soils formed in alluvium on terraces.

In a representative profile the surface layer is brown fine sandy loam 12 inches thick. The subsoil is 28 inches thick. The upper 9 inches is yellowish-brown loam, the next 8 inches is strong-brown sandy clay loam, and the lower 11 inches is strong-brown light sandy clay loam. The substratum, at a depth of 40 inches, extends to a depth of 84 inches or more. It is strong-brown loamy fine sand and gravelly sand that has lenses of light-gray gravelly sand in the lower part.

Available water capacity is medium in Kalmia soils. Reaction is very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 5 feet or more in wet seasons. The soils are occasionally flooded.

Representative profile of Kalmia fine sandy loam, 0 to 2 percent slopes, 1⅛ miles northwest of Bottoms Bridge, one-fourth mile west of the Chickahominy River, 400 feet south of Boar Swamp, 250 feet north of the Southern Railroad:

Ap—0 to 12 inches, brown (10YR 4/3) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; few medium and many fine roots; few rounded pebbles; very strongly acid; clear, smooth boundary.

B1t—12 to 21 inches, yellowish-brown (10YR 5/6) loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium and fine roots; common medium pores; few rounded pebbles; few thin patchy clay films; very strongly acid; clear, smooth boundary.

B21t—21 to 29 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium and fine roots; few rounded pebbles; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22t—29 to 40 inches, strong-brown (7.5YR 5/8) light sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium pores; few rounded pebbles; few thin patchy clay films; very strongly acid; clear, smooth boundary.

C1—40 to 50 inches, strong-brown (7.5YR 5/6) loamy fine sand; single grained; very friable, nonsticky and nonplastic; few rounded pebbles; very strongly acid; clear, smooth boundary.

IIC2—50 to 84 inches, strong-brown (7.5YR 5/6) gravelly sand that has lenses of light-gray (10YR 7/1) gravelly sand; single grained; very strongly acid.

The solum ranges from 28 to 40 inches in thickness. Depth to bedrock is more than 5 feet. Fine rounded pebbles, ranging from less than 1 percent to about 10 percent, by volume, of the solum, are common throughout the solum.

In the A horizon hue is 10YR, value is 4 or 5, and chroma is 2 and 3.

In the Bt horizon hue is 10YR and 7.5YR, value is 5 or 6, and chroma is 4 to 8. The Bt horizon ranges from heavy fine sandy loam to sandy clay loam.

The C horizon is commonly strong brown or yellowish brown and often contains lenses of grayish material in the lower part. The C horizon ranges from loamy fine sand to sand and gravel but may be sandy loam to sandy clay loam in areas near uplands or along small drainageways.

Kalmia soils are similar to soils in the Altavista, State, and Tetotum series. They are better drained than Altavista and Tetotum soils and do not have the low-chroma mottles in the upper 24 inches of the Bt horizon that are characteristic of these soils. They are more strongly acid than State soils and contain more sand throughout the solum.

Kalmia soils are commonly near Altavista, Lenoir, and Pactolus soils. They are better drained and have a less clayey subsoil than Lenoir soils and do not have gray mottles in the upper part of the Bt horizon. They have a Bt horizon, which is not characteristic of Pactolus soils.

Kalmia fine sandy loam, 0 to 2 percent slopes (KaA).—This soil is on broad, low-lying terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Altavista soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 2o1.

Kalmia fine sandy loam, 2 to 10 percent slopes (KaC).—This soil is on low-lying terraces.

Included with this soil in mapping are small areas of moderately well drained Altavista soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 2o1.

Kempsville Series

The Kempsville series consists of deep, well-drained, nearly level to steep soils that have a loamy subsoil. These soils formed in loamy Coastal Plain sediments.

In a representative profile the surface layer is brown fine sandy loam 11 inches thick. The subsoil is 49 inches thick. The upper 6 inches is yellowish-brown heavy fine sandy loam. The next 13 inches is yellowish-brown sandy clay loam. The next 23 inches is strong-brown sandy clay loam that has pale-brown mottles. The lower 7 inches is yellowish-brown sandy clay loam. The substratum, at a depth of 60 inches, extends to a depth of 108 inches or more. In the upper part, it is yellowish-brown sandy clay loam that has red and strong-brown mottles. Gray material is below a depth of 72 inches, and loamy fine sand is below a depth of 80 inches.

Available water capacity is medium in Kempsville soils. Reaction is very strongly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Kempsville fine sandy loam, 0 to 2 percent slopes, 1¾ miles northeast of Henrico High School, 900 feet west of the Chickahominy River:

O1—1½ inches to 0, partly decomposed leaves, pine needles, and twigs.

Ap—0 to 11 inches, brown (10YR 5/3) fine sandy loam; weak, medium, granular structure; very friable, nonsticky and nonplastic; many large medium and fine roots; very strongly acid; clear, smooth boundary.

B1t—11 to 17 inches, yellowish-brown (10YR 5/4) heavy fine sandy loam; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; common large, medium, and fine roots; few medium and fine pores; moderately thick clay coatings on sand grains and common bridging; very strongly acid; clear, smooth boundary.

B21t—17 to 30 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; common medium and fine roots; few medium and fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22t—30 to 53 inches, strong-brown (7.5YR 5/6) sandy clay loam; common medium, distinct, pale-brown (10YR 6/3) mottles of fine sandy loam; weak, thick, platy structure that parts to weak, fine, subangular blocky structure; friable, slightly sticky and slightly plastic; somewhat compact in place; few medium and fine roots; few medium and fine pores; few small rounded pebbles; thin

patchy clay films; very strongly acid; gradual, smooth boundary.

B3t—53 to 60 inches, yellowish-brown (10YR 5/8) sandy clay loam; weak, coarse, subangular blocky structure; friable, slightly sticky and slightly plastic; few medium and fine roots; few thin, patchy strong-brown (7.5YR 5/6) clay films; strongly acid; gradual, smooth boundary.

C1—60 to 72 inches, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/6) sandy clay loam; common medium, distinct, red (2.5YR 4/8) mottles; massive; friable, slightly sticky and slightly plastic, strongly acid; gradual, smooth boundary.

C2—72 to 80 inches, yellowish-brown (10YR 5/8), light-gray (10YR 7/1), and red (2.5YR 4/8) light sandy clay loam; massive; friable, slightly sticky and slightly plastic; very strongly acid; gradual, smooth boundary.

C3—80 to 108 inches, gray (10YR 6/1) and brownish-yellow (10YR 6/6) loamy fine sand; single grained; very friable, nonsticky and nonplastic; very strongly acid.

The solum ranges from about 45 to 60 inches in thickness. Depth to bedrock is more than 5 feet. These soils are commonly free of pebbles; however, a few soils have a solum that has 5 to 15 percent pebbles and a C horizon that is gravelly or very gravelly.

In the Ap horizon hue is 10YR and occasionally 2.5Y, value is 4 or 5, and chroma is 2 to 4. When present, the A2 horizon is commonly 1 value higher. The A horizon is commonly fine sandy loam but ranges to sandy loam and very fine sandy loam.

In the Bt horizon hue is 10YR and 7.5YR, value is 4 to 6, and chroma is 4 to 8. The Bt horizon ranges from sandy clay loam to heavy fine sandy loam and clay loam.

The C horizon is commonly mottled in yellowish brown, strong brown, and red and has gray color below a depth of about 72 inches. The C horizon is commonly loamy and sandy, but some soils have a clayey C horizon below a depth of about 60 inches.

Kempsville soils are similar to soils in the Bourne Kalmia, and Norfolk series. They have a thicker solum than Kalmia soils. They have a somewhat brittle and compact B22t horizon, which is not characteristic of Norfolk soils.

Kempsville soils are near Bourne, Faceville, Norfolk, and Ruston soils. They have less clayey Bt horizons than Faceville soils and have less red lower Bt horizons and a thinner solum than Ruston soils. They do not have the fragipan that is characteristic of Bourne soils.

Kempsville fine sandy loam, 0 to 2 percent slopes (KeA).—This soil is on broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne and Tetotum soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Kempsville fine sandy loam, 2 to 6 percent slopes (KeB).—This soil is on broad ridges and side slopes.

Included with this soil in mapping are small areas of moderately well drained Bourne and Tetotum soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Kempsville fine sandy loam, 2 to 10 percent slopes, eroded (KeC2).—This soil is on ridges and side slopes. It has a thinner surface layer than the one in the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne soils on some of the more gentle slopes and small areas of well-drained Faceville and Norfolk soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of further erosion is moderate to severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Kempsville fine sandy loam, 10 to 25 percent slopes, eroded (KeD2).—This soil is on side slopes and hillsides. The surface layer is thinner than the one in the profile described as representative of the series. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of well-drained Caroline soils. Also included are small areas of gravelly, sandy, and clayey soils.

Runoff is rapid on this soil, and the soil is slightly droughty under prevailing climatic conditions. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover.

Most of the acreage of this soil is wooded, and small areas are used for cultivated crops and pasture. Capability unit IVe–1; woodland suitability group 3r2.

Kempsville fine sandy loam, flooded, 0 to 2 percent slopes (KfA).—This soil is on foot slopes, along drainageways, and at the heads of drainageways.

Included with this soil in mapping are small areas of soils that are more sandy or more silty than the soil described as representative of the series. Also included are a few areas of less well drained soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. A seasonal high water table is at a depth of 4 feet or more, and the soil is occasionally flooded.

About half of the acreage of this soil is used for cultivated crops and pasture, and the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 3o1.

Kempsville fine sandy loam, flooded, 2 to 6 percent slopes (KfB).—This soil is on foot slopes, along drainageways, and at the heads of drainageways.

Included with this soil in mapping are small areas of soils that are more sandy or more silty than the soil described as representative of the series.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion from seepage and runoff from higher areas is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops. A seasonal high water table is at a depth of 4 feet or more, and the soil is occasionally flooded.

About half of the acreage of this soil is used for cultivated crops and pasture, and the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 3o1.

Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes (KgA).—This soil is on broad ridges. It differs from the profile described as representative of the series by containing a subsoil of clay loam and clay below a depth of about 50 inches.

Included with this soil in mapping are small areas of moderately well drained Atlee soils in slight depressions and small areas of well-drained Caroline and Faceville soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled.

About half of the acreage of this soil is used for cultivated crops or pasture, and the rest is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes (KgB).—This soil is on broad, slightly convex ridgetops. It differs from the profile described as representative of the series by containing a subsoil of clay loam and clay below a depth of about 50 inches.

Included with this soil in mapping are small areas of moderately well drained Atlee soils in slight depressions and small areas of well-drained Caroline and Faceville soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded (KgC2).—This soil is on side slopes. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is loam or light clay loam. It differs from the profile described as representative of the series by containing a subsoil of clay loam and clay below a depth of about 50 inches.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, and some small areas are used for cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Kinston Series

The Kinston series consists of deep, poorly drained, nearly level soils that have a loamy subsoil. These soils formed in loamy alluvium on flood plains.

In a representative profile the surface layer is silt loam 6 inches thick. The upper part is dark gray, and the lower part is gray and has strong-brown mottles. The subsoil is 68 inches thick. The upper 34 inches is dark-gray clay loam and has yellowish-brown mottles. The lower 34 inches is gray and reddish-brown sandy clay loam. The substratum, at a depth of 74 inches, extends to a depth of 120 inches or more. It consists of layers of gray sandy clay loam and fine sandy loam or sand and gravel.

Available water capacity is high in Kinston soils. Reaction is very strongly acid, and permeability is moderate in the subsoil. The soils are frequently flooded.

Representative profile of Kinston silt loam, 1 mile northeast of Meadow Road, three-fourths mile north of Southern Railroad, and one-eighth mile west of Chickahominy River:

O1—½ inch to 0, partly decomposed leaves and twigs.

A1—0 to 2 inches, dark-gray (10YR 4/1) silt loam; moderate, medium, granular structure; very friable, slightly sticky and nonplastic; many medium and fine roots; very strongly acid; abrupt, smooth boundary.

A2—2 to 6 inches, gray (10YR 5/1) silt loam; many medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, granular structure; very friable, slightly sticky and nonplastic; many medium and fine roots; very strongly acid; clear, smooth boundary.

B2g—6 to 40 inches, dark-gray (10YR 4/1) clay loam; common medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; common medium and fine roots; gray silt coatings on walls of larger pores; very strongly acid; gradual, irregular boundary.

B3g—40 to 74 inches, gray (10YR 5/1) and reddish-brown (5YR 4/4) sandy clay loam; weak, coarse, subangular blocky structure; firm, slightly sticky and slightly plastic; few medium and fine roots; few fine pebbles; very strongly acid; gradual, smooth boundary.

Cg—74 to 120 inches, gray (N 5/0) and dark-gray (N 4/0) stratified sandy clay loam and fine sandy loam; many fine, prominent, dark-brown (7.5YR 4/4) mottles; massive; friable, slightly sticky and nonplastic; pockets of clay, sand, and gravel; few fine roots; strongly acid.

The solum ranges from 40 to 60 inches or more in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR, value is 4 or 5, and chroma is 1 or 2. The A horizon is commonly silt loam but ranges to fine sandy loam.

In the B horizon hue is 10YR and 2.5Y, value is 4 to 6, and chroma is 1 or 2. In places it is mixed gray and reddish brown, strong brown, or yellowish brown in the lower part. The B horizon is commonly clay loam and sandy clay loam but ranges to loam and fine sandy loam.

The C horizon is stratified and ranges from sandy clay loam to sand and gravel.

Kinston soils are similar to soils in the Chastain, Chewacla, Mantachie, and Roanoke series. They are less clayey than Chastain and Roanoke soils and do not have the Bt horizon that is characteristic of Roanoke soils. They are less well drained then Chewacla and Mantachie soils.

Kinston soils are commonly near Chewacla, Lenoir, Mantachie, and Roanoke soils. They are more poorly drained, than Lenoir soils and do not have the clayey Bt horizon that is characteristic of these soils.

Kinston silt loam (Km).—This nearly level soil is on stream flood plains and along large drainageways. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Chastain, Chewacla, and Mantachie soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight. A seasonal high water table is at a depth of 0 to 1 foot. Some areas are ponded in wet season.

Most of the acreage of this soil is wooded. Capability unit IVw–1; woodland suitability group 2w3.

Kinston and Mantachie soils (Kn).—The Kinston and Mantachie soils in this unit are similar. They are nearly level soils on flood plains and along drainageways. Slopes are 2 percent or less. About 40 percent of the acreage of this mapping unit is Kinston soil, and about 35 percent is Mantachie soil. Some areas are entirely Kinston soil, some are entirely Mantachie soil, and others contain both soils. Each soil has the profile described as representative of their respective series. Surface textures include silt loam, fine sandy loam, or loam.

Included with these soils in mapping are small areas of Chewacla soils. Also included are small areas of sandy and gravelly soils and small swampy areas. These inclusions make up about 25 percent of the mapping unit.

Runoff is slow on these soils, and they are not droughty under prevailing climatic conditions. The soils are friable and are easily tilled. The hazard of erosion is slight. A seasonal high water table is at a depth of 0 to 1½ feet, and drainage is desirable if the soils are used for farming.

Most of the acreage of these soils is wooded. Capability unit IVw–1; woodland suitability group 2w3.

Lenoir Series

The Lenoir series consists of deep, somewhat poorly drained, nearly level soils that have a dominantly clayey subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is pale-brown silt loam 6 inches thick. The subsoil is 64 inches thick. The upper 8 inches is light yellowish-brown silty clay loam that has gray and yellowish-brown mottles. The next 29 inches is gray clay that has strong-brown mottles. The lower 27 inches is light-gray and strong-brown silty clay. The substratum, at a depth of 70 inches, extends to a depth of 110 inches or more. It is gray, red, and yellowish-brown clay.

Available water capacity is medium in Lenoir soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 1 to 1½ feet in wet seasons, and the soils are frequently flooded along the Chickahominy River, but not along the James River or on uplands.

Representative profile of Lenoir silt loam, three-eighths mile southwest of Fort Lee, five-sixteenths mile west of Monahan Road, five-sixteenths mile south of C&O Railroad:

O1—1 inch to 0, partly decomposed pine needles and twigs.

Ap—0 to 6 inches, pale-brown (10YR 6/3) silt loam; moderate, fine, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; very strongly acid; clear, smooth boundary.

B1t—6 to 14 inches, light yellowish-brown (2.5Y 6/4) silty clay loam; few fine, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; friable, sticky and plastic; common medium and fine roots; few fine pores; thin patchy clay films; very strongly acid; gradual, smooth boundary.

B2tg—14 to 43 inches, gray (10YR 6/1) clay; many medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3tg—43 to 70 inches, light-gray (5Y 7/1, N 7/0) and strong-brown (7.5YR 5/8) silty clay; weak, medium, angular blocky structure; firm, sticky and plastic; few fine roots; thin patchy clay films; very strongly acid; gradual, smooth boundary.

C—70 to 110 inches, gray (N 6/0), red (10Y 4/6), and yellowish-brown (10YR 5/8) clay; massive; firm, sticky and plastic; changing to sandy clay loam in the lower part; very strongly acid.

The solum ranges from about 64 to 96 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 2.5Y and 10YR, value is 3 to 6, and chroma is 1 to 4. The A horizon is commonly silt loam but ranges to loam and very fine sandy loam.

In the upper part of the Bt horizon due is 2.5Y and 10YR, value is 4 to 6, and chroma is 3 to 8. The upper part of the Bt horizon is commonly silty clay loam but ranges to clay loam and heavy sandy clay loam. The Btg horizon is gray or light gray that has strong-brown and yellowish-brown mottles. The Btg horizon is commonly clay but ranges to silty clay, sandy clay, and heavy clay loam.

The C horizon is mixed gray, red, yellowish-brown, and strong-brown clay and ranges to sandy clay loam.

Lenoir soils are similar to soils in the Angie, Coxville, Duplin, and Helena series. They have dominant chroma of less than 2 between the base of the A horizon and a depth of 30 inches, while the Angie, Duplin, and Helena soils have dominant chroma of more than 2. Lenoir soils have higher chroma in the upper part of the Bt horizon than Coxville soils, which are dominantly gray throughout the Bt horizon.

Lenoir soils are near Atlee, Coxville, Duplin, Lynchburg, and Rains soils. They do not have the weak fragipan that is characteristic of Atlee soils. They have more clayey Bt horizons than Lynchburg and Rains soils.

Lenoir silt loam (Le).—This nearly level soil is on broad upland flats and on some low-lying stream terraces. Dominant slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of moderately well drained Altavista and Atlee soils,

somewhat poorly drained Lynchburg soils, and poorly drained Coxville and Roanoke soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. This soil is cloddy if it is tilled when it is too wet or too dry. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

About one-fourth of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. It is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIIw–1; woodland suitability group 3w1.

Lynchburg Series

The Lynchburg series consists of deep, somewhat poorly drained, nearly level soils that have a thick loamy subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is fine sandy loam 14 inches thick. It is black in the upper part and light yellowish brown in the lower part. The subsoil is 90 inches thick. The upper 11 inches is light olive-brown light clay loam that has gray mottles. The next 22 inches is gray and brownish-yellow clay loam. The lower 57 inches is gray clay loam that has yellowish-brown mottles. The substratum, at a depth of 104 inches, extends to a depth of 110 inches or more. It is gray and brownish-yellow loamy sand and changes to gravel in the lower part.

Available water capacity is high in Lynchburg soils. Reaction is extremely acid to very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 1 to 1½ feet in wet seasons.

Representative profile of Lynchburg fine sandy loam, 1 mile south of Highway Springs, seven-eighths mile west of Fair Oaks, 200 feet east of Oak Street, 100 feet south of the Southern Railroad:

O1—1 inch to 0, partly decomposed leaves, pine needles, and twigs.

A1—0 to 4 inches, black (N 2/0) fine sandy loam; moderate, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; extremely acid; abrupt, smooth boundary.

A2—4 to 14 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam; moderate, fine, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; few fine pores; extremely acid; clear, smooth boundary.

B21t—14 to 25 inches, light olive-brown (2.5Y 5/4) light clay loam; common medium, distinct, gray (N 6/0) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium and fine roots; few fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.

B22tg—25 to 47 inches, gray (10YR 6/1) and brownish-yellow (10YR 6/8) clay loam; weak, medium, angular blocky structure; firm, slightly sticky and slightly plastic; few fine roots; few fine pores; thin patchy clay films; very strongly acid; gradual, smooth boundary.

B3tg—47 to 104 inches, gray (N 6/0) clay loam; common medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; firm, sticky and plastic; thin patchy clay films; very strongly acid; gradual, smooth boundary.

IIC—104 to 110 inches, gray (10YR 6/1) and brownish-yellow (10YR 6/8) loamy sand that has lenses of clay; changing into gravel in lower part; very strongly acid.

The solum ranges from about 86 to 113 inches in thickness. Depth to bedrock is more than 5 feet.

In the A1 horizon hue is 10YR, 2.5Y, and N, value is 2 to 4, and chroma is 2 or less. In the A2 horizon hue is 2.5Y and 10YR, value is 5 or 6, and chroma is 1 to 4. The A2 horizon is fine sandy loam but ranges to very fine sandy loam.

In the B21t horizon hue is 2.5Y and 10YR, value is 5 or 6, and chroma is 4 to 8. In the B22tg and B3tg horizons, hue is 10YR, 2.5Y, 5Y, and N, value is 4 to 6, and chroma is 2 or less. The B22tg and B3tg horizons have brownish-yellow, yellowish-brown, and light olive-brown mottles. The Bt horizon is clay loam, light clay loam, and sandy clay loam.

The C horizon is gray and brownish-yellow loamy sand or sandy loam that has lenses of clay and that commonly changes to gravel with increasing depth.

Lynchburg soils are similar to soils in the Altavista, Atlee, Bertie, Lenoir, and Myatt series. They have gray mottles just below the A horizon that are not characteristic of Altavista soils. They do not have the weak fragipan that is characteristic of Atlee soils. Lynchburg soils do not have mica present in the lower Bt and C horizons, as is characteristic in Bertie soils. They have less clayey Bt horizons than Lenoir soils. They have a thicker solum and an upper Bt horizon that has chroma of more than 2, and Myatt soils do not.

Lynchburg soils are similar to soils in the Altavista, Lenoir, and Rains soils. They are less well drained than the well-drained, clayey Caroline soils. They are better drained than Coxville soils and have less clayey Bt horizons. They are less poorly drained than Rains soils and have an upper Bt horizon with chroma of more than 2.

Lynchburg fine sandy loam (Ly).—This nearly level soil is on upland flats and in small upland depressions. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of moderately well drained Atlee soils and small areas of poorly drained Rains soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. Drainage is desirable if the soil is used for farming.

About one-third of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess water. Capability unit IIIw–1; woodland suitability group 2w2.

Mantachie Series

The Mantachie series consists of deep, somewhat poorly drained, nearly level soils that have a loamy subsoil. The Mantachie soils in Henrico County are mapped only in complex with Chastain soils and in an undifferentiated group with Kinston soils.

In a representative profile the surface layer is 17 inches thick. The upper 4 inches is dark grayish-brown loam, the next 8 inches is light olive-brown loam, and the lower 5 inches is grayish-brown very fine sandy loam. The subsoil is 30 inches thick. The upper 4 inches is light brownish-gray and yellowish-brown light clay loam. The next 14 inches is light brownish-

gray and gray silty clay loam that has red and yellowish-brown mottles. The lower 12 inches is light brownish-gray and gray clay loam that has red and yellowish-brown mottles. The substratum, at a depth of 47 inches, extends to a depth of 91 inches or more. It is yellowish-brown sandy clay loam that has gray mottles.

Available water capacity is high in Mantachie soils. Reaction is very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 1 to 1½ feet, and the soils are frequently flooded.

Representative profile of Mantachie loam in an area of Mantachie-Chastain complex, 1¼ miles east of Seven Pines, 400 feet west of Clayman Road, and one-fourth mile south of U.S. Route 60:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, granular structure; friable, slightly sticky and nonplastic; many medium and fine roots; very strongly acid; clear, smooth boundary.

A12—4 to 12 inches, light olive-brown (2.5Y 5/4) loam; moderate, medium, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; very strongly acid; clear, smooth boundary.

A3g—12 to 17 inches, grayish-brown (2.5Y 5/2) very fine sandy loam; weak, medium, granular structure; friable, nonsticky and nonplastic; common medium and fine roots; very strongly acid; abrupt, smooth boundary.

B21—17 to 21 inches, light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/8) light clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common fine roots; few medium and fine pores; very strongly acid; clear, smooth boundary.

B22g—21 to 35 inches, light brownish-gray (2.5Y 6/2) and gray (10YR 6/1) silty clay loam; many medium, prominent, red (2.5YR 4/6) and many medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; very strongly acid; clear, smooth boundary.

B23g—35 to 47 inches, light brownish-gray (2.5Y 6/2) and gray (10YR 6/1) clay loam; many medium, prominent, red (2.5YR 4/6) and many medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, coarse, subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; very strongly acid; gradual, smooth boundary.

C—47 to 91 inches, stratified yellowish-brown (10YR 5/8) sandy clay loam, fine sandy loam, and silty clay loam; many coarse, distinct, gray (10YR 6/1) mottles; massive; friable, slightly sticky and slightly plastic; very strongly acid.

The solum ranges from 40 to 60 inches in thickness.

In the A horizon hue is 10YR and 2.5Y, value is 4 or 5, and chroma is 2 to 4. The A horizon is commonly loam but ranges to fine sandy loam and very fine sandy loam.

In the B horizon hue is 2.5Y and 10YR, value is 5 or 6, and chroma is 1 or 2. Red and yellowish-brown mottles are in the lower part of the B horizon. The B horizon is clay loam and silty clay loam but ranges to loam, silt loam, and sandy clay loam.

The C horizon is commonly stratified and ranges from silty clay loam and sandy clay loam to silt loam, fine sandy loam, and loamy fine sand.

Mantachie soils are similar to soils in the Chastain, Chewacla, and Kinston series. They are not as poorly drained as Chastain and Kinston soils and do not have the clayey B horizon that is characteristic of Chastain soils. They have colors of lower chroma in the B horizon than Chewacla soils.

Mantachie soils are near Chastain, Kinston, Lynchburg, and Tetotum soils. They do not have the Bt horizon that is characteristic of Lynchburg and Tetotum soils.

Mantachie-Chastain complex (Mc).—This soil complex consists of nearly level Mantachie and Chastain soils that are intermingled in such an intricate pattern that it is not practical to map them separately. About 40 percent of the total acreage of this complex is Mantachie soil, and about 35 percent is Chastain soil. The remaining 25 percent consists of other soils. This complex is on narrow bottoms along drainageways and streams. Slopes are dominantly 0 to 2 percent. Surface textures are dominantly loam or fine sandy loam.

Included with these soils in mapping are small areas of Chewacla and Kinston soils. Also included are small swampy areas and small areas of gravelly and sandy soils.

Runoff is slow on the soils of this complex, and the soils are not droughty under prevailing climatic conditions. Drainage is desirable if these soils are used for farming. These soils are frequently flooded.

Most of the acreage of these soils is wooded, and some small areas are in pasture. Capability unit IVw–1; woodland suitability group 3w2.

Mayodan Series

The Mayodan series consists of deep, well-drained, gently sloping soils that have a dominantly clayey subsoil. These soils formed in the weathered products of sandstone and shale.

In a representative profile the surface layer is brown fine sandy loam about 6 inches thick. The subsoil is 43 inches thick. The upper 5 inches is yellowish-red heavy fine sandy loam, and the next 38 inches is dark-red clay. The substratum, at a depth of 49 inches, extends to a depth of about 101 inches or more. It is dark-red, very dark gray, and reddish-yellow weathered shale.

Available water capacity is medium in Mayodan soils. Reaction is very strongly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Mayodan fine sandy loam, 2 to 6 percent slopes, eroded, 2 miles southwest of Short Pump, one-half mile west of Gayton Road:

O1—1 inch to 0, partly decomposed pine needles and cones, leaves, and twigs.

Ap—0 to 6 inches, brown (10YR 5/3) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common large, medium, and fine roots; strongly acid; abrupt, smooth boundary.

B1t—6 to 11 inches, yellowish-red (5YR 4/6) heavy fine sandy loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium and fine roots; few fine pores; few thin patchy clay films; very strongly acid; clear, smooth boundary.

B2t—11 to 37 inches, dark-red (2.5YR 3/6) clay; strong, fine, subangular blocky structure; friable, sticky and slightly plastic; few medium and fine roots; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3t—37 to 49 inches, dark-red (2.5YR 3/6) clay; moderate, thick, platy structure; friable, slightly sticky and

slightly plastic; few medium and fine roots; common fine mica flakes; olive-brown and very dark gray weathered shale fragments comprise 15 to 30 percent, by volume; thin patchy clay films; very strongly acid; gradual, smooth boundary.

C—49 to 101 inches, dark-red (2.5YR 3/6), very dark gray (10YR 3/1), and reddish-yellow (7.5YR 6/8) strongly weathered shale that crushes to silty clay loam; rock-controlled structure; common fine mica flakes; very strongly acid.

The solum ranges from about 39 to 59 inches in thickness. Depth to bedrock is 4 feet or more.

In the A horizon hue is 10YR and 7.5YR, value is 4 to 6, and chroma is 2 to 4. The A horizon is fine sandy loam or loam.

The B1t horizon, when present, is yellowish-red (5YR 4/6 and 4/8) or reddish-yellow (7.5YR 6/6 and 6/8) heavy fine sandy loam or heavy loam. The B2t horizon and B3t horizon range from dark-red (2.5YR 3/6) to yellowish-red (5YR 5/6 and 5/8) clay or silty clay.

The C horizon is strongly weathered shale and sandstone that crushes to silty clay loam and fine sandy loam.

Mayodan soils in this survey area have a redder hue in the subsoil in most places than Mayodan soils in other survey areas. This difference, however, does not alter their usefulness or management.

Mayodan soils are similar to soils of the Cecil, Creedmoor, and Turbeville series. They contain less sand and more silt in the Bt horizon and have a somewhat thinner solum than Cecil soils. They are better drained than Creedmoor soils. They have a thinner solum than Turbeville soils.

Mayodan soils are near Appling, Cecil, Creedmoor, and Turbeville soils. They have a redder Bt horizon than Appling soils.

Mayodan fine sandy loam, 2 to 6 percent slopes, eroded (MdB2).—This soil is on somewhat broad ridges. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is clay loam.

Included with this soil in mapping are small areas of moderately well drained Creedmoor soil. Also included are small areas of sloping soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are in cultivated crops or pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Myatt Series

The Myatt series consists of deep, poorly drained, nearly level soils that have a loamy subsoil. These soils formed in alluvium.

In a representative profile the surface layer is fine sandy loam 15 inches thick. It is very dark gray in the upper part and light brownish gray in the lower part. The subsoil is 52 inches thick. The upper 22 inches is gray light clay loam. The lower 30 inches is gray fine sandy loam. The subsoil contains strong-brown mottles throughout. The substratum, at a depth of 67 inches, extends to a depth of 102 inches or more. It is dark-gray loamy fine sand and sand.

Available water capacity is medium in Myatt soils. Reaction is very strongly acid to extremely acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 0 to 1 foot during wet seasons, and the soil is frequently flooded.

Representative profile of Myatt fine sandy loam, five-eighths mile southeast of Creighton Road, one-half mile west of the Chickahominy River, one-eighth mile east of end of farm road:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

A1—0 to 3 inches, very dark gray (10YR 3/1) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; extremely acid; abrupt, smooth boundary.

A2—3 to 15 inches, light brownish-gray (10YR 6/2) fine sandy loam; few medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, fine granular structure; very friable; nonsticky and nonplastic; few medium and fine roots; very strongly acid; clear, irregular boundary.

B2tg—15 to 37 inches, gray (10YR 6/1) light clay loam; common medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure parting to weak, medium, angular blocky; friable, sticky and slightly plastic; few medium and fine roots; few fine mica flakes; thin patchy clay films; extremely acid; gradual, smooth boundary.

B3tg—37 to 67 inches, gray (5Y 6/1) fine sandy loam; common medium, distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few fine mica flakes; sand grains are coated and bridged with clay; very strongly acid; clear, wavy boundary.

IICg—67 to 94 inches, dark-gray (5Y 4/1) loamy fine sand and sand; single grained; very friable, nonsticky and nonplastic; few fine mica flakes; extremely acid.

The solum ranges from about 53 to 67 inches in thickness. Depth to bedrock is more than 5 feet.

In the A1 horizon hue is 10YR, value is 3 to 5, and chroma is 1. In the A2 horizon and Ap horizon hue is 10YR, value is 4 to 6, and chroma is 1 and 2. The A2 horizon and Ap horizon commonly contain yellowish-brown mottles. The A horizon ranges from fine sandy loam to sandy loam and loam.

In the B2t horizon and B3tg horizon hue is 10YR to 5Y, value is 4 or 6, and chroma is 1. Strong-brown and yellowish-brown mottles are present throughout. The B2tg horizon ranges from sandy clay loam to clay loam. The B3tg horizon ranges from fine sandy loam to heavy loam and light clay loam.

The C horizon consists of layers of dark-gray or gray loamy fine sand and sand and ranges to sand and gravel in some places.

Myatt soils are similar to soils in the Portsmouth, Rains, and Roanoke series. They do not have the thick, dark-colored A horizon that is characteristic of Portsmouth soils. They have fine mica flakes in the Bt horizon and C horizon, which Rains soils do not have, and they have a thinner solum than Rains soils. They have less clayey Bt horizons than Roanoke soils.

Myatt soils are commonly near Altavista, Buncombe, Portsmouth, and Roanoke soils. They are more poorly drained than Altavista and Buncombe soils, and they have a gray Bt horizon that is not characteristic of Buncombe soils.

Myatt fine sandy loam (My).—This nearly level soil is on broad, low-lying stream terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of very poorly drained Portsmouth soils and poorly

drained Roanoke soils. Also included are small areas of sandy and gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight. Drainage and flood protection are desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, but some areas are in cultivated crops and pasture. This soil has a limited suitability for most crops commonly grown in the county, especially for those that are sensitive to excess wetness and flooding. Capability unit IVw–1; woodland suitability group 2w3.

Norfolk Series

The Norfolk series consists of deep, well-drained, nearly level to sloping soils that have a thick loamy subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is fine sandy loam 18 inches thick. It is dark grayish brown in the upper part and yellowish brown in the lower part. The subsoil is strong-brown sandy clay loam 45 inches thick. Structure surfaces are brown. Brownish-yellow mottles are at a depth of 41 inches, and gray and red mottles are at a depth of 53 inches. The substratum, at a depth of 63 inches, extends to a depth of 115 inches or more. It is mottled gray, yellowish-brown, and red clay.

Available water capacity is medium in Norfolk soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability is moderate.

Representative profile of Norfolk fine sandy loam, 2 to 6 percent slopes, three-fourths mile north of Laburnum Avenue and on the fairgrounds, one-fourth mile west of the C&O Railroad:

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many fine roots; few small rounded pebbles; very strongly acid; abrupt, smooth boundary.

A2—11 to 18 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; few fine roots; few fine pores; few small rounded pebbles; very strongly acid; clear, smooth boundary.

B1t—18 to 26 inches, strong-brown (7.5YR 5/6) light sandy clay loam; weak, medium, subangular blocky structure; friable, slighty sticky and nonplastic; few fine roots; few small rounded pebbles; few thin patchy clay films; strongly acid; clear, smooth boundary.

B21t—26 to 41 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure that has brown (7.5YR 4/4) surfaces; friable, slightly sticky and nonplastic; few fine roots; few small rounded pebbles; thin patchy clay films; strongly acid; clear, smooth boundary.

B22t—41 to 53 inches, strong-brown (7.5YR 5/6) sandy clay loam; common fine, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium, angular blocky structure that has brown (7.5YR 4/4) surfaces; friable, slightly sticky and nonplastic; few small rounded pebbles; thin continuous clay films; gradual, smooth boundary.

B3t—53 to 63 inches, strong-brown (7.5YR 5/8) sandy clay loam; common fine, distinct, gray (10YR 6/1) and red (2.5YR 4/8) mottles; moderate, coarse, angular blocky structure with brown (7.5YR 4/4) surfaces; friable, slightly sticky and nonplastic; few small rounded pebbles; thin patchy clay films; very strongly acid; clear, smooth boundary.

C—63 to 115 inches, mottled, gray (10YR 6/1), yellowish-brown (10YR 5/8), and red (2.5YR 4/8) clay; massive; firm, sticky and plastic; sand content increases with increasing depth; very strongly acid.

The solum ranges from about 63 to 84 inches in thickness. Depth to bedrock is more than 5 feet. Small rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 10 percent, by volume.

In the A1 hue is 10YR, value is 4 or 5, and chroma is 1 and 2. In the A2 horizon hue is 10YR, value is 5 or 6, and chroma is 3 and 4. The A2 horizon is fine sandy loam or sandy loam.

In the B1t and B2t horizons, hue is 7.5YR and 10YR, value is 5 or 6, and chroma is 6 to 8. Brownish-yellow and yellowish-brown mottles often are in the lower part of the B2t horizon; structure faces are often brown (7.5YR 4/4). Color in the B3t horizon is commonly the same as the color in the B2t horizon, but the B3t horizon has gray and red mottles. The Bt horizon is commonly sandy clay loam but ranges to clay loam and heavy loam.

The C horizon is clay to sandy clay loam. Gray, yellowish-brown, strong-brown, and red mottles are present throughout.

Norfolk soils are similar to soils in the Atlee, Caroline, Duplin, Faceville, Kalmia, and Tetotum series. They do not have the fragipan that is characteristic of Atlee soils. They are less clayey than Caroline, Duplin, and Faceville soils and have a yellower solum than Faceville soils. They have a thicker solum than Kalmia and Tetotum soils and do not have the gray mottles in the upper 24 inches of the Bt horizon that are characteristic of Tetotum soils.

Norfolk soils are near Atlee, Caroline, Faceville, Kempsville, Rumford, and Sassafras soils. They have thicker Bt horizons than Kempsville and Sassafras soils. They are not as excessively drained as Rumford soils and have a thicker solum and a finer-textured Bt horizon than Rumford soils.

Norfolk fine sandy loam, 0 to 2 percent slopes (NoA).—This soil is on broad ridges.

Included with this soil in mapping are small areas of moderately well drained Bourne soils in slight depressions and small areas of well-drained Kempsville soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Norfolk fine sandy loam, 2 to 6 percent slopes (NoB).—This soil is on somewhat broad, weakly convex ridgetops. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and well-drained Caroline soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Norfolk fine sandy loam, 6 to 10 percent slopes (NoC).—This soil is on side slopes.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and well-drained Caroline soils. Also included are small areas of gravelly soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, and small areas are in cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Ochrepts and Udults

Ochrepts and Udults are deep soils that formed in interbedded layers of sandy, loamy, clayey, and gravelly Coastal Plain sediments, in sloping to steep areas along the larger, more deeply incised drainageways, and in sloping to steep areas between uplands and flood plains and terraces along the larger streams. The surface layer ranges from loamy fine sand and loamy sand to clay, and is gravelly to extremely gravelly in places. The color of the surface layer ranges from gray, pale brown, and brown to yellowish red. The underlying layers range from sand and fine sand to clay, and some are gravelly to extremely gravelly. The underlying layers are gray to red, and they are mottled in many areas of the finer textured soils. Springs and seepage areas are common, especially along the lower parts of the steeper slopes. The soil material is moderately well drained to excessively drained.

Available water capacity ranges from low to medium in Ochrepts and Udults. Reaction is commonly extremely acid to strongly acid in the substrata but ranges to medium acid on some lower slopes with marl influence. Permeability ranges from moderately rapid to moderately slow.

Ochrepts and Udults, sloping (OUD).—The soils in this mapping unit are on side slopes between ridges, on side slopes along drainageways, on slopes between uplands and terraces, on slopes between terraces, and on slopes between terraces and bottom lands. About 45 percent of the acreage of this unit is Ochrepts, and about 30 percent is Udults. Some areas are entirely Ochrepts soil, some are entirely Udults soil, and others contain both soils. Slopes are dominantly 6 to 15 percent.

Included with these soils in mapping are small areas of Altavista, Bourne, Caroline, Norfolk, Kempsville, Ruston, and Sassafras soils. These soils make up about 25 percent of the acreage of the mapping unit.

Runoff is rapid on the soils of this unit, and the soils are somewhat droughty under prevailing climatic conditions. The hazard of erosion is severe if the soils are disturbed and left without plant cover.

Most of the acreage of these soils is wooded. Capability unit VIe–1; woodland suitability group 2o1.

Ochrepts and Udults, steep (OUF).—The soils in this mapping unit are on side slopes along drainageways, on slopes between uplands and terraces, on slopes between terraces, and on slopes between terraces and bottom lands. About 50 percent of the acreage of the mapping unit is Ochrepts, and about 35 percent is Udults. Some areas are entirely Ochrepts soil, some are entirely Udults soil, and others contain both soils. Slopes are dominantly 15 to 50 percent.

Included with these soils in mapping are small areas of Caroline, Kempsville, and Pamunkey soils. These soils comprise about 15 percent of the acreage of the mapping unit.

Runoff is rapid on the soils in this unit, and the soils are somewhat droughty under prevailing climatic conditions. They are somewhat excessively drained to excessively drained. The hazard of erosion is very severe if the soils are disturbed and left without plant cover.

Most of the acreage of this mapping unit is wooded. Capability unit VIIe–1; woodland suitability group 2r1.

Orange Series

The Orange series consists of deep, somewhat poorly drained, nearly level soils that have a dominantly clayey subsoil. These soils formed in material weathered from schist and gneiss.

In a representative profile the surface layer is loam 12 inches thick. It is dark grayish brown in the upper part and yellowish red and light gray in the lower part. The subsoil is 24 inches thick. It is strong-brown clay that has gray mottles. The substratum, at a depth of 36 inches, extends to a depth of 43 inches. It is weathered schist. Schist bedrock is at a depth of 43 inches.

Available water capacity is medium in Orange soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 1 to 1½ feet. The soils are frequently flooded.

Representative profile of Orange loam, 3 miles north of Short Pump, 1⅘ miles northeast of Pouncey Tract Road:

O1—1 inch to 0, partly decomposed leaves, twigs, and pine needles.

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; very friable, slightly sticky and nonplastic; common medium and fine roots; few rounded pebbles; strongly acid; clear, smooth boundary.

A2—6 to 12 inches, yellowish-red (5YR 4/8) and light-gray (10YR 7/1) loam; weak, fine, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; few rounded pebbles; strongly acid; clear, smooth boundary.

B2t—12 to 36 inches, strong-brown (7.5YR 5/8) clay; common medium, distinct, gray (10YR 5/1) mottles; strong, medium, prismatic structure parting to moderate, medium, angular blocky; very firm, very sticky and very plastic; few medium and fine

roots; few rounded pebbles; thin continuous clay films; strongly acid; gradual, smooth boundary.
C—36 to 43 inches, strong-brown (7.5YR 5/6) and gray (10YR 6/1) strongly weathered rock; rock-controlled structure; few rounded pebbles; few thin clay flows in upper part; strongly acid.
R—43 inches, schist.

The solum ranges from 30 to 40 inches in thickness. Depth to bedrock is 3½ to 5 feet. Rounded quartz pebbles are in the solum and substratum and range from less than 1 percent to about 3 percent, by volume.

In the A1 horizon hue is 10YR, value is 3 or 4, and chroma is 1 or 2. In the A2 horizon color value is 5 to 7, and chroma is 6 to 8. Hue is 7.5YR and 5YR. The A horizon ranges from loam to fine sandy loam and silt loam.

In the B2t horizon hue is 10YR and 7.5YR, value is 5 or 6, and chroma is 4 to 8. In the mottles hue is 10YR and 2.5Y, value is 5 or 6, and chroma is 2 or less. The B2t horizon ranges from clay to sandy clay and heavy clay loam.

The C horizons have gray, strong-brown, and yellowish-brown mottles.

Orange soils are similar to soils in the Lenoir and Roanoke series. They have a thinner solum than either of these soils. They are better drained than Roanoke soils, which have a gray Bt horizon.

Orange soils commonly are near Appling, Bourne, Colfax, and Helena soils. They are more poorly drained than Appling soils, which do not have gray colors in the Bt horizon. They do not have the fragipan that is characteristic of Bourne and Colfax soils. They are more poorly drained than the Helena soils, which do not have gray mottles in the upper part of the Bt horizon.

Orange loam (Ov).—This nearly level soil is on upland flats. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Colfax soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight. Slight depressions are ponded in wet seasons.

Most of the acreage of this soil is wooded. Capability unit IIIw–1; woodland suitability group 4w1.

Orthents-Udults-Mine Pits Complex

Orthents-Udults-Mine pits complex (OW) is in the Triassic Basin in the western part of Henrico County where coal seams were in the sandstone and shale. It is along Big Tuckahoe Creek and Gayton Road north of Patterson Avenue, along the upper reaches of Deep Run Creek, and along Springfield Road between Hungary and Nuchols Roads. It consists of mine pits and shafts, mounds of mine spoil, and the soils of the area, all intermingled in such an intricate pattern that it was not practical to map them separately. About 38 percent of the complex is Orthents, and about 32 percent is Udults. These include soils of the Colfax, Creedmoor, Mayodan, and Pinkston series, and others. Many of these soils were disturbed in mining operations. About 30 percent of the complex is mine pits and their associated mine spoil. Slopes range from about 2 to 25 percent.

Runoff ranges from slow to rapid on this complex. Reaction ranges from very strongly acid to extremely acid in the soils and spoil materials. Permeability is moderate to very slow. The hazard of erosion ranges from slight to severe when the soils are without plant cover.

Most of the acreage of this complex is wooded (fig. 3). Capability unit VIIe–1; woodland suitability group unclassified.

Pactolus Series

The Pactolus series consists of deep, moderately well drained, nearly level sandy soils. These soils formed in sandy alluvium on terraces.

In a representative profile the surface layer is dark grayish-brown loamy fine sand 9 inches thick. The substratum between depths of 9 and 35 inches is light yellowish-brown loamy fine sand that has light-gray mottles in the lower part. Between depths of 35 and 41 inches, the substratum is brownish-yellow loamy sand that has light-gray mottles, and it is light-gray sand between depths of 41 and 66 inches or more.

Available water capacity is low in Pactolus soils. Reaction is very strongly acid throughout, and permeability is rapid in the substratum. A seasonal high water table is at a depth of 1½ to 2½ feet in wet seasons. The soils are occasionally flooded.

Representative profile of Pactolus loamy fine sand, 2 miles north of Highland Springs, 400 feet south of Creighton Road, one-half mile west of the Chickahominy River:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; single grained; loose, nonsticky and nonplastic; common fine roots; few rounded pebbles; very strongly acid; abrupt, smooth boundary.
C1—9 to 28 inches, light yellowish-brown (10YR 6/4) loamy fine sand; single grained; loose, nonsticky and nonplastic; few rounded pebbles; very strongly acid; gradual, wavy boundary.
C2—28 to 35 inches, light yellowish-brown (10YR 6/4) loamy fine sand; few fine, faint, light-gray (10YR 7/1) mottles; single grained; loose, nonsticky and nonplastic; few rounded pebbles; very strongly acid; gradual wavy boundary.
C3—35 to 41 inches, brownish-yellow (10YR 6/6) loamy sand; few fine, faint, light-gray (10YR 7/1) mottles; single grained; loose, nonsticky and nonplastic; few rounded pebbles; very strongly acid; gradual, wavy boundary.
C4g—41 to 66 inches, light-gray (2.5Y 7/2) sand; single grained; loose, nonsticky and nonplastic; few rounded pebbles; very strongly acid.

Depth to bedrock is more than 5 feet. Rounded quartz pebbles commonly are throughout the profile, ranging from 0 to about 10 percent, by volume, of the soil material.

In the A horizon hue is 10YR, value is 4 or 5, and chroma is 1 and 2. The A horizon ranges from loamy fine sand to loamy sand.

In the C horizon, above a depth of about 40 inches, hue is 10YR and 7.5YR, value is 5 to 7, and chroma is 4 to 6. Light-gray or gray mottles are at a depth below about 28 inches. The C horizon ranges from loamy fine sand to loamy sand. The C horizon, below a depth of about 40 inches, is commonly light-gray or gray sand to sand and gravel.

Pactolus soils are similar to soils of the Altavista, Buncombe, and Kalmia series. They do not have the Bt horizon that is characteristic of Altavista soils. They have mottles of chroma 2 or less at a depth of about 28 inches, which Buncombe and Kalmia soils do not have. They do not have the Bt horizon that is characteristic of Kalmia soils.

Pactolus soils commonly are near Altavista, Bertie, Buncombe, Myatt, and Portsmouth soils. They are better drained than Bertie, Myatt, and Portsmouth soils. They do not have the Bt horizon and gray color in the upper part of the solum that are characteristic of these soils.

Figure 3.—**Natural reforestation on Orthents-Udults-Mine pits complex.**

Pactolus loamy fine sand (Pa).—This nearly level soil is on broad terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Lenoir soils in slight depressions and small areas of excessively drained Buncombe soils in slightly elevated areas. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is droughty under prevailing climatic conditions. The soil is very friable and is easily tilled. Drainage and flood protection are desirable if the soil is used for farming.

Most of the acreage of this soil is wooded. This soil has a limited suitability for most crops commonly grown in the county, especially for those that are sensitive to excess wetness or droughtiness. Capability unit IIIs–1; woodland suitability group 2s1.

Pamunkey Series

The Pamunkey series consists of deep, well-drained, nearly level to sloping soils with loamy subsoils. These soils formed in loamy alluvium on stream terraces.

In a representative profile the surface layer is brown fine sandy loam 9 inches thick. The subsoil is brown sandy clay loam about 48 inches thick. The substratum, at a depth of 59 inches, extends to a depth of 118 inches or more. It is brown light sandy clay loam.

Available water capacity is medium in Pamunkey soils. Reaction is slightly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Pamunkey fine sandy loam, 0 to 2 percent slopes, 1¼ mile southwest of Eaves Lake and Mill Road, three-sixteenths mile east of James River:

Ap—0 to 9 inches, brown (10YR 4/3) fine sandy loam; moderate, fine, granular structure; very friable, slightly sticky and nonplastic; many fine roots; few rounded pebbles; neutral; abrupt, smooth boundary.

B2t—9 to 43 inches, brown (7.5YR 4/4) sandy clay loam; weak, coarse, subangular blocky structure; friable, sticky and nonplastic; few fine roots; few fine pores; few rounded pebbles; few fine black concretions; thin patchy clay films; slightly acid; clear, smooth boundary.

B3t—43 to 57 inches, brown (7.5YR 4/4) sandy clay loam; weak, very coarse, subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; few fine pores; few rounded pebbles; few fine black concretions; few fine mica flakes; few thin patchy clay films; strongly acid; gradual, smooth boundary.

C—57 to 118 inches, brown (7.5YR 4/4) light sandy clay loam; massive; friable, slightly sticky and nonplastic; few fine mica flakes; strongly acid.

The solum ranges from about 40 to 65 inches in thickness. Depth to bedrock is more than 5 feet. Rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 10 percent, by volume, of the soil material. Mica flakes commonly are in the lower part of the Bt horizon and C horizon.

In the A horizon hue is 10YR and 7.5YR, value is 3 or 4, and chroma is 2 to 4. The A horizon ranges from fine sandy loam to loam.

In the Bt horizon hue is 7.5YR and 5YR, value is 4 or 5, and chroma is 3 or higher. The Bt horizon is commonly sandy clay loam but ranges from clay loam to loam.

The C horizon ranges from reddish-brown to yellowish-brown sandy clay loam to sand and gravel.

Pamunkey soils are similar to soils in the Sassafras and State series. They have a thicker Bt horizon than Sassafras soils and have mixed mineralogy while Sassafras soils have siliceous mineralogy. They have a thicker Bt horizon than State soils.

Pamunkey soils are near Altavista, Angie, Buncombe, Chastain, Roanoke, and State soils. They are better drained than the Altavista and Angie soils and do not have mottles of chroma 2 or less in the upper 24 inches of the Bt horizon. They are better drained, have less clay, and are not gray and mottled like Chastain soils. They have Bt horizons which the Buncombe soils do not have. They are less clayey and do not have the gray Bt horizons that are characteristic of Roanoke soils.

Pamunkey fine sandy loam, 0 to 2 percent slopes (PmA).—This soil is on broad terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Altavista soils in slight depressions and small areas of gravelly soils. Also included are small areas of soils that have a loamy plow layer and a solum thicker than 60 inches.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

Most of the acreage of this soil is used for cultivated crops or pasture. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 2o1.

Pamunkey fine sandy loam, 2 to 6 percent slopes (PmB).—This soil is on broad terraces.

Included with this soil in mapping are small areas of gravelly soils. Also included are small areas of soils that have a loamy plow layer and a solum thicker than 60 inches.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is used for cultivated crops or pasture. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 2o1.

Pamunkey fine sandy loam, 6 to 15 percent slopes (PmD).—This soil is on terraces. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of gravelly soils. Also included are small areas of soils that have a loamy plow layer and a solum thicker than 60 inches.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 2o1.

Pamunkey clay loam, 6 to 15 percent slopes, severely eroded (PnC3).—This soil is on terraces. The clay loam surface layer is mostly subsoil material. In some less severely eroded soils, the surface layer is loam, fine sandy loam, or sandy clay loam. This soil has a profile somewhat thinner than the one described as representative of the series.

Included with this soil in mapping are small areas of gravelly soils and small gullied areas.

Runoff is medium to rapid on this soil, and the soil is somewhat droughty under prevailing climatic conditions. The hazard of further erosion is very severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil has a limited suitability for most crops commonly grown in the county. Capability unit IVe–2; woodland suitability group 2o1.

Pinkston Series

The Pinkston series consists of moderately deep, somewhat excessively drained to excessively drained, sloping to moderately steep soils that have a loamy subsoil. These soils formed in material weathered from sandstone and shale.

In a representative profile the surface layer is dark yellowish-brown fine sandy loam about 6 inches thick. The subsoil is 5 inches thick. It is brown fine sandy loam that contains small irregular areas of yellowish-red silty clay loam. The substratum, at a depth of 11 inches, extends to a depth of about 36 inches. It is strongly weathered sandstone that crushes easily to yellowish-brown and strong-brown fine sandy loam. Hard sandstone is at a depth of about 36 inches.

Available water capacity is low in Pinkston soils. Reaction is very strongly acid throughout. Permeability is moderately rapid in the subsoil.

Representative profile of Pinkston fine sandy loam, 6 to 25 percent slopes, three-fourths mile southwest of Short Pump, one-fourth mile southwest of Gayton Road, and 50 feet east of Big Tuckahoe Creek:

A1—0 to 6 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; moderate, fine, granular structure; friable, nonsticky and nonplastic; many roots; few fine mica flakes; very strongly acid; abrupt, smooth boundary.

B—6 to 11 inches, brown (10YR 4/3) fine sandy loam containing lenses of yellowish-red (5YR 4/6), slightly plastic silty clay loam; weak, fine, subangular blocky structure; friable; common roots; common

fine mica flakes; very strongly acid; abrupt, smooth boundary.

C—11 to 36 inches, yellowish-brown (10YR 5/6) with thin layers of strong-brown (7.5YR 5/6) fine sandy loam; massive; very friable, nonsticky and nonplastic; few roots; 49 percent coarse sandstone fragments, by volume; common fine mica flakes; very strongly acid; diffuse, irregular boundary.

R—36 inches, sandstone.

The solum ranges from about 8 to 12 inches in thickness. Depth to bedrock ranges from about 24 to 36 inches. Coarse fragments of weathered sandstone comprise less than 10, percent by volume, of the A horizon and B horizon and about 40 percent, by volume, of the C horizon. Fine mica flakes commonly are throughout the solum and C horizon.

In the A horizon hue is 10YR and 2.5Y, value is 4, and chroma is 2 to 4. The A horizon is fine sandy loam or sandy loam.

In the B horizon hue is 10YR, 7.5YR, and 5YR, value is 4 or 5, and chroma is 3 to 6. The B horizon is fine sandy loam or sandy loam. Lenses and small irregular areas of silty clay loam are in the B horizon and are commonly yellowish red.

The C horizon is yellowish-brown, strong-brown, and, in places, yellowish-red fine sandy loam and sandy loam to loam.

Pinkston soils in this survey area have a thinner solum than Pinkston soils in other survey areas. This, however, does not alter their usefulness or management.

Pinkston soils are similar to soils in the Ashlar series. They have a thinner solum and more fine sand than Ashlar soils, and they have small areas of silty clay loam in the B horizon, which Ashlar soils do not have.

Pinkston soils are near Bourne, Creedmoor, and Mayodan soils. They do not have the fragipan that is characteristic of Bourne soils. They have a thinner solum and do not have the Bt horizon that is characteristic of Creedmoor and Mayodan soils.

Pinkston fine sandy loam, 6 to 25 percent slopes (PoE).—This soil is mostly on hillsides.

Included with this soil in mapping are small areas of very shallow soils, gravelly soils, and rock outcrops.

Runoff is rapid on this soil, and the soil is droughty under prevailing climatic conditions. The hazard of erosion is very severe if the soil is disturbed and left without plant cover.

Most of the acreage of this soil is wooded. Capability unit VIe–1; woodland suitability group 4d2.

Portsmouth Series

The Portsmouth series consists of deep, very poorly drained, nearly level soils that have a loamy subsoil. These soils formed in loamy alluvium on low-lying terraces.

In a representative profile the surface layer is 20 inches thick. It is silt loam that is very dark gray in the upper part and black in the lower part. The subsoil is gray sandy clay loam 13 inches thick. The substratum, at a depth of 33 inches, extends to a depth of 95 inches or more. It is gray, pale-olive, and greenish-gray loamy fine sand and fine sand.

Available water capacity is medium in Portsmouth soils. Reaction is extremely acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 0 to 1 foot. The soils are often ponded in wet seasons. They are frequently flooded.

Representative profile of Portsmouth silt loam, 1½ miles north of Highland Springs, three-fourths mile southeast of Creighton Road, one-fourth mile west of the Chickahominy River:

O1—2 inches to 0, partly decomposed leaves, twigs, and gumballs.

A11—0 to 10 inches, very dark gray (10YR 3/1) silt loam; strong, medium, granular structure; friable, slightly sticky and nonplastic; many large, medium, and fine roots; extremely acid; clear, smooth boundary.

A12—10 to 20 inches, black (10YR 2/1) silt loam; strong, medium, granular structure; friable, slightly sticky and slightly plastic; many medium and fine roots; extremely acid; clear, smooth boundary.

B2tg—20 to 33 inches, gray (10YR 5/1) sandy clay loam; common medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, coarse, angular blocky structure; friable, slightly sticky and slightly plastic; common fine roots; thin patchy clay films; extremely acid; clear, smooth boundary.

C1g—33 to 55 inches, gray (5Y 6/1) and pale-olive (5Y 6/3) loamy fine sand; single grained; loose, nonsticky and nonplastic; few fine roots; extremely acid; gradual, smooth boundary.

C2g—55 to 95 inches, greenish-gray (5GY 6/1) fine sand; single grained; loose, nonsticky and nonplastic; extremely acid.

The solum ranges from about 26 to 38 inches in thickness. Depth to bedrock is more than 5 feet.

In the A horizon hue is 10YR, value is 3 or less, and chroma is 2 or less. The A horizon ranges from silt loam to loam.

In the Bt horizon hue is 10YR and 2.5Y, value is 4 to 6, and chroma is 2 or less. Strong-brown and yellowish-brown mottles are often present. The Bt horizon ranges from sandy clay loam to clay loam.

In the C horizon hue is 5Y, 5GY, and N, value is 5 or 6, and chroma is 3 or less.

Portsmouth soils are similar to soils in the Forestdale, Myatt, and Roanoke series. They have less clay in the subsoil than Forestdale soils. They have thick, dark A horizons which are not characteristic of Myatt soils. They have less clayey Bt horizons than Roanoke soils.

Portsmouth soils are near Kalmia, Lenoir, and Myatt soils. They are more poorly drained than Kalmia soils, which do not have a gray Bt horizon. They are more poorly drained and have a less clayey Bt horizon than Lenoir soils.

Portsmouth silt loam (Pr).—This nearly level soil is on low-lying terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of poorly drained Myatt soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight.

Most of the acreage of this soil is wooded. Capability unit IVw–1; woodland suitability group 2w3.

Pouncey Series

The Pouncey series consists of moderately deep, poorly drained, nearly level soils that have a heavy loamy subsoil. These soils formed in a mantle of fluvial materials in depressions at the heads of drainageways and at the bases of slopes.

In a representative profile the surface layer is 10 inches thick. It is grayish-brown sandy loam in the upper part and light brownish-gray sandy loam that has brownish-yellow mottles in the lower part. The subsoil is 15 inches thick. It is gray heavy clay loam that has strong-brown mottles. Light-gray, olive, and

dark-gray sandstone that has olive-yellow mottles is at a depth of 25 inches.

Available water capacity is low in Pouncey soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 0 to 1 foot. The soils are frequently flooded.

Representative profile of Pouncey sandy loam, 1¾ miles north of Short Pump, one-eighth mile east of Pouncey Tract Road:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) sandy loam; few fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine, granular structure; very friable; common medium and fine roots; few rounded quartz pebbles; very strongly acid; abrupt, smooth boundary.

A2g—6 to 10 inches, light brownish-gray (2.5Y 6/2) sandy loam; few fine, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium, granular structure; very friable; few medium and fine roots; few fine pores; few rounded quartz pebbles; very strongly acid; abrupt, smooth boundary.

B2tg—10 to 25 inches, gray (5Y 5/1) heavy clay loam; many medium, prominent, strong-brown (7.5YR 5/8) mottles; weak, very coarse, prismatic structure parting to weak, medium and coarse, angular blocky; firm, sticky, plastic; few medium and fine roots; thin patchy clay films on faces of peds; thick clay flows fill pores in the lower 1 inch of the horizon and cover the underlying sandstone as a discontinuous capping up to 1 inch thick; very strongly acid; clear, wavy boundary.

IIR—25 inches, light-gray (10YR 7/2) (70 percent), olive (5Y 5/4), and dark-gray (5Y 4/1) (30 percent) extremely hard and weakly cemented sandstone; few medium, distinct, olive-yellow (2.5Y 6/6) mottles; massive parting when either moist or dry and with extreme difficulty to very thick (approximately 1 inch) platy structure; fine roots follow points of weakness in a horizontal dimension within the plates and form mats between the plates at least in the upper 2 to 4½ inches; mats are approximately 1 inch wide and disconnected; very fine feeder roots can be detected under magnification; common fine and medium pores; very dark grayish-brown (2.5Y 3/2) clay flows around the olive bodies, in root channels, around the roots mat between the plates, and lining the pores; few rounded quartz pebbles; medium acid.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Rounded quartz pebbles are commonly 3 to 5 percent of the solum.

In the Ap horizon hue is 10YR and 2.5Y, value is 5 or 6, and chroma is 1 and 2. The A2g horizon ranges in color from light brownish gray (2.5Y 6/2) to light gray (10YR 6/1). The A horizon is sandy loam, fine sandy loam, loam, or silt loam.

In the matrix of the B2tg horizon, hue is 5Y or 2.5Y, value is 5 or less, and chroma is 2 or less. The B2t horizon is heavy clay loam or clay. In the mottles of the A horizon and B horizon, hue is 2.5YR, 5YR, 7.5YR, or 10YR, value is 4 to 6, and chroma is 4 to 8.

Pouncey soils are similar to soils in the Colfax series. They are more poorly drained than the Colfax soils and do not have the fragipan that is characteristic of these soils.

Pouncey soils commonly are near Bourne, Cecil, Colfax, and Helena soils. They are more poorly drained than Bourne soils and do not have the fragipan that is characteristic of these soils. They are more poorly drained and have a thinner solum than Cecil and Helena soils.

Pouncey sandy loam (Ps).—This nearly level soil is on upland depressions, around the heads of drainageways, and on areas at the bases of slopes and between drainageways. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Colfax soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight.

Most of the acreage of this soil is wooded, and small areas are used for pasture. Capability unit IVw–1; woodland suitability group 2w3.

Psamments

Psamments, gently sloping (PTB) consists of areas of land covered over by several feet or more of spoil materials dredged from the channel of the James River. Slopes are dominantly 2 to 6 percent but range from 0 to 10 percent in some small areas. These spoil materials are dominantly sand or loamy sand and are excessively drained to somewhat poorly drained. Reaction is strongly acid to very strongly acid, and permeability is moderately rapid.

Included with the spoil materials in mapping are small areas of Altavista, Chastain, Chewacla, Lenoir, Pamunkey, and Roanoke soils.

Runoff is slow on these spoil materials, and these materials are droughty under prevailing climatic conditions. A seasonal high water table is at a depth of 2½ to 5 feet. These spoil materials have a limited suitability for farming. Capability unit unclassified; woodland suitability group unclassified.

Rains Series

The Rains series consists of deep, poorly drained, nearly level soils that have a thick subsoil that is loamy to a depth of about 45 to 50 inches and clayey below that depth. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is 11 inches thick. It is grayish-brown very fine sandy loam that has yellowish-brown mottles in the lower part. The subsoil is gray clay loam that has strong-brown mottles in the upper 38 inches and gray clay that has yellowish-brown mottles in the lower 47 inches. The substratum, at a depth of 96 inches, extends to a depth of 102 inches or more and is gray sandy clay loam that has yellow mottles.

Available water capacity is high in Rains soils. Reaction is very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 0 to 1 foot. The soils are flooded in wet seasons.

Representative profile of Rains very fine sandy loam, in Highland Springs at the southwestern corner of Nine Mile Road and Taft Street:

O1—1 inch to 0, partly decomposed pine cones, needles, leaves, and twigs.

Ap—0 to 7 inches, grayish-brown (10YR 5/2) very fine sandy loam; weak, fine, granular structure; friable, slightly sticky and nonplastic; common medium and fine roots; very strongly acid; abrupt, smooth boundary.

A2—7 to 11 inches, grayish-brown (2.5Y 5/2) very fine sandy loam; common fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, granular

structure; friable, slightly sticky and nonplastic; common medium and fine roots; few medium and fine pores; very strongly acid; clear, smooth boundary.

B21tg—11 to 23 inches, gray (10YR 5/1) clay loam; common fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; firm, sticky and slightly plastic; common medium and fine roots; few fine pores; few small rounded pebbles; thin patchy clay films; very strongly acid; clear, irregular boundary.

B22tg—23 to 49 inches, gray (10YR 5/1) clay loam; common medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; firm, sticky and slightly plastic; few medium and fine roots; few fine pores; few small rounded pebbles; thin patchy clay films; very strongly acid; gradual, irregular boundary.

B3tg—49 to 96 inches, gray (N 5/0) clay; many coarse, prominent, yellowish-brown (10YR 5/8) mottles; moderate, coarse, angular blocky structure; very firm; sticky and plastic; few fine roots in the upper part; few small rounded pebbles; thin, continuous clay films; very strongly acid; gradual, irregular boundary.

C—96 to 102 inches, gray (N 5/0) sandy clay loam; massive; firm, sticky and slightly plastic; few small rounded pebbles; very strongly acid.

The solum ranges from about 85 to 113 inches in thickness. Depth to bedrock is more than 5 feet. Small rounded quartz pebbles commonly are present throughout the solum, ranging from less than 1 percent to about 5 percent, by volume of the soil material.

In the A horizon hue is 10YR and 2.5Y, value is 5, and chroma is 1 and 2. The A horizon is very fine sandy loam, fine sandy loam, and loam.

In the Bt horizon, above about 45 to 50 inches, hue is 10YR and 2.5Y, value is 5 or 6, and chroma is 1 and 2. The upper part of the Bt horizon is clay loam or sandy clay loam. In the Bt horizon, below a depth of about 45 to 50 inches, hue is 5Y and N, value is 4 to 6, and chroma is 2 or less. The lower part of the Bt horizon is clay or heavy clay loam. Strong-brown and yellowish-brown mottles are present throughout the Bt horizon.

The C horizon is gray sandy clay loam to clay.

Rains soils are similar to soils in the Coxville, Lenoir, Lynchburg, and Myatt series. They are less clayey than Coxville soils in the upper 20 inches of the Bt horizon. They have lower chroma between the base of the A horizon and a depth of 30 inches than Lenoir and Lynchburg soils. They are less clayey than Lenoir soils in the upper 20 inches of the Bt horizon. They have a thicker Bt horizon than Myatt soils.

Rains soils are near Atlee, Coxville, Duplin, Lenoir, and Lynchburg soils. They do not have the weak fragipan that is characteristic of Atlee soils. The are more gray in the Bt horizon and less well drained than Duplin soils.

Rains very fine sandy loam (Ra).—This nearly level soil is on upland flats in slight depressions. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of moderately well drained Atlee soils and poorly drained Coxville soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. Drainage is desirable if the soil is used for farming.

Most of the acreage of this soil is wooded, and small areas are used for cultivated crops or pasture. This soil has limited suitability for most crops commonly grown in the county, especially for those that are sensitive to excess wetness. Capability unit IVw–1; woodland suitability group 2w3.

Riverview Series

The Riverview series consists of deep, well-drained, nearly level soils that have a loamy subsoil. These soils formed in alluvium on the flood plain.

In a representative profile the surface layer is silt loam 5 inches thick. It is dark brown in the upper part and brown in the lower part. The subsoil is brown heavy silt loam 22 inches thick. The substratum, at a depth of 27 inches, extends to a depth of 104 inches or more. It is brown heavy silt loam in the upper part and very dark grayish-brown silt loam in the lower part.

Available water capacity is high in Riverview soils. Reaction is strongly acid to very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 4 feet or more. The soils are frequently flooded.

Representative profile of Riverview silt loam, 2¾ miles south of Richmond, 1 mile west of Osborne Turnpike, 100 feet east of the James River:

A11—0 to 2 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, granular structure; friable, nonsticky and nonplastic; many medium and fine roots; common fine mica flakes; strongly acid; clear, smooth boundary.

A12—2 to 5 inches, brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable, nonsticky and nonplastic; many medium and fine roots; common fine mica flakes; strongly acid; clear, smooth boundary.

B—5 to 27 inches, brown (7.5YR 4/4) heavy silt loam; weak, coarse, prismatic structure parting to weak, coarse, angular blocky; friable, nonsticky and nonplastic; common medium and fine roots; few medium and fine pores; common fine mica flakes; strongly acid; clear, smooth boundary.

C1—27 to 56 inches, brown (7.5YR 4/4) heavy silt loam; lenses of brown (7.5YR 4/4) loamy fine sand; massive; firm, nonsticky and nonplastic; few fine roots; common fine mica flakes; strongly acid; gradual, smooth boundary.

C2—56 to 104 inches, very dark grayish-brown (2.5Y 3/2) silt loam; massive; friable, slightly sticky and nonplastic; common fine mica flakes; common rounded pebbles in the lower part; very strongly acid.

The solum ranges from about 26 to 40 inches in thickness. Depth to bedrock is more than 5 feet. Thin bedding planes of contrasting textures are in many pedons. Few to many mica flakes are in most horizons.

In the A horizon hue is 10YR or 7.5YR, value is 3 to 5, and chroma is 3 to 5. The A horizon is silt loam, loam, and very fine sandy loam.

In the B horizon hue is 7.5YR and 10YR, value is 4 or 5, and chroma is 3 to 6. The B horizon ranges from heavy silt loam to loam and very fine sandy loam.

In the C horizon hue is 7.5YR, 10YR, and 2.5Y, value is 3 to 5, and chroma is 2 to 4. The C horizon ranges from loamy sand to silty clay and is gravelly in some places.

Riverview soils are similar to soils in the Chewacla, State, and Toccoa series. They are better drained than Chewacla soils and do not have chroma 2 mottles in the subsoil. They do not have the Bt horizon that is characteristic of State soils and contain more silt and less sand throughout the solum than Toccoa soils.

Riverview soils are near Chewacla, Pamunkey, Roanoke, and State soils. They do not have the Bt horizon that is characteristic of Pamunkey soils. They are better drained and do not have the gray Bt horizon that is characteristic of Roanoke soils.

Riverview silt loam (Re).—This nearly level soil is on broad bottom lands along the James River. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of Chewacla and Toccoa soils. Also included are small areas of gravelly and sandy soils.

Runoff is slow on this soil and the soil is not droughty under prevailing climatic conditions. This soil is friable and is easily tilled. The hazard of erosion is slight.

Most of the acreage of this soil is used for cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 1o1.

Roanoke Series

The Roanoke series consists of deep, poorly drained, nearly level soils that have a dominantly clayey subsoil. These soils formed in alluvium, mostly on terraces.

In a representative profile the surface layer is silt loam 6 inches thick. It is dark gray in the upper part and grayish brown in the lower part. The subsoil is light olive-gray clay mottled with brownish yellow in the upper 48 inches. Between depths of 54 and 90 inches, it is strong-brown light silty clay that has gray mottles. The substratum, at a depth of 90 inches, extends to a depth of 98 inches or more. It is strong-brown clay loam that has gray mottles.

Available water capacity is medium in Roanoke soils. Reaction is very strongly acid in the subsoil, and permeability is slow. A seasonal high water table is at a depth of 0 to 1 foot in winter and in spring. The soils are occasionally to frequently flooded.

Representative profile of Roanoke silt loam, one-half mile north of Eaves Lake and Mill Road, one-fourth mile east of James River:

O1—1 inch to 0, partly decomposed leaves, pine needles, and twigs.

A1—0 to 1 inch, dark-gray (10YR 4/1) silt loam; moderate, fine, granular structure; very friable, slightly sticky and nonplastic; many large, medium, and fine roots; very strongly acid; abrupt, smooth boundary.

A2—1 to 6 inches, grayish-brown (2.5Y 5/2) silt loam; moderate, fine, granular structure; friable, slightly sticky and nonplastic; common large, medium, and fine roots; few fine pores; very strongly acid; clear, smooth boundary.

B2tg—6 to 54 inches, light olive-gray (5Y 6/2) clay; common medium, prominent, brownish-yellow (10YR 6/8) mottles; strong, coarse, prismatic structure parting to moderate, medium, angular blocky; very firm, very sticky and very plastic; few medium and fine roots; thin continuous clay films; very strongly acid; diffuse, irregular boundary.

B3t—54 to 90 inches, strong-brown (7.5YR 5/6) light silty clay; many medium, prominent, gray (5Y 6/1) mottles; moderate, very coarse, prismatic structure parting to moderate, coarse, angular blocky; firm, sticky and plastic; few medium and fine roots; few small rounded pebbles; thin patchy clay films; very strongly acid; gradual, irregular boundary.

C—90 to 98 inches, strong-brown (7.5YR 5/6) clay loam; few fine, prominent, gray (N 6/0) mottles; massive; firm, sticky and slightly plastic; lenses of ferruginous sandstone with ferruginous sandstone at a depth of 98 inches; very strongly acid.

The solum ranges from about 78 to 102 inches in thickness. Depth to bedrock is more than 5 feet.

In the A1 horizon hue is 10YR and 2.5Y, value is 2 to 4, and chroma is 1 and 2. In the A2 and Ap horizons hue is 2.5Y and 10YR, value is 5 or 6, and chroma is 1 and 2. The A horizon is silt loam or loam.

In the B2t horizon hue is 5Y, 2.5Y, and 10YR, value is 5 or 6, and chroma is 1 and 2. Brownish-yellow, yellowish-brown, and strong-brown mottles are present throughout. The B2 horizon is commonly clay but ranges to silty clay and heavy clay loam. The B3t horizon ranges from strong brown (7.5YR 5/6) to gray (10YR 5/1).

The C horizon is commonly strong brown or yellowish brown and has gray mottles but ranges to gray and light gray. It ranges from clay loam to clay.

Roanoke soils are similar to soils in the Myatt and Pouncey series. They have a more clayey subsoil than Myatt soils, which have less than 35 percent clay in the Bt horizon. They have more silt and less sand than Pouncey soils.

Roanoke soils are near Altavista, Lenoir, and Pamunkey soils. They are more poorly drained than Altavista and Pamunkey soils and have a more clayey subsoil. They are more poorly drained than Lenoir soils and have gray Bt horizons below the A horizons, while Lenoir soils have light yellowish-brown Bt horizons just below the A horizons.

Roanoke silt loam (Ro).—This nearly level soil is on broad river terraces. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of moderately well drained Altavista soils and somewhat poorly drained Lenoir soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The hazard of erosion is slight.

Most of the acreage of this soil is wooded because artificial drainage is generally difficult to achieve, but small areas are used for cultivated crops and pasture. Capability unit IVw–1; woodland suitability group 1w2.

Rumford Series

The Rumford series consists of deep, somewhat excessively drained, nearly level to sloping soils that have a loamy subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is loamy sand that is brown in the upper part and yellowish brown in the lower part. It is 18 inches thick. The subsoil is strong-brown sandy loam 20 inches thick. The substratum, at a depth of 38 inches, extends to a depth of 82 inches or more. It is strong-brown loamy fine sand and gravelly sandy loam.

Available water capacity is low in Rumford soils. Reaction is medium acid to very strongly acid in the subsoil, and permeability is rapid.

Representative profile of Rumford loamy sand, 0 to 10 percent slopes, one-half mile east of Fourmile Creek Baptist Church, one-fourth mile north of New Market Road:

Ap—0 to 9 inches, brown (10YR 4/3) loamy sand; weak, fine, granular structure; very friable; common fine roots; few rounded pebbles; very strongly acid; abrupt, smooth boundary.

A2—9 to 18 inches, yellowish-brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; few fine roots; few rounded pebbles; very strongly acid; clear, smooth boundary.

B1t—18 to 27 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, subangular blocky structure; very friable, slightly sticky and nonplastic; few

fine roots; few medium pores; few rounded pebbles; thin clay coatings on sand grains and bridging between grains; medium acid; gradual, smooth boundary.

B2t—27 to 38 inches, strong-brown (7.5YR 5/6) sandy loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few medium pores; few rounded pebbles; thin clay coatings on sand grains and bridging between grains; medium acid; gradual, smooth boundary.

C1—38 to 76 inches, strong-brown (7.5YR 5/6) loamy fine sand; single grained; loose; lenses of slightly compact loamy fine sand in lower part; few rounded pebbles; medium acid; clear, smooth boundary.

C2—76 to 82 inches, strong-brown (7.5YR 5/6) gravelly sandy loam; massive; very friable, slightly sticky and nonplastic; strongly acid.

The solum ranges from about 30 to 40 inches in thickness. Depth to bedrock is more than 5 feet. Fine, rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 10 percent, by volume, of the soil material.

In the A horizon hue is 10YR, value is 4 to 6, and chroma is 3 to 6. The A horizon is loamy sand or loamy fine sand.

In the Bt horizon hue is 7.5YR and 5YR, value is 4 to 6, and chroma is 6 to 8. The Bt horizon ranges from sandy loam and fine sandy loam to light sandy clay loam.

The C horizon is strong brown and yellowish brown, ranging to white. The C horizon ranges from loamy fine sand, loamy sand, and sand to gravelly sandy loam and gravelly loamy sand.

Rumford soils are similar to soils in the Kempsville, Norfolk, and Sassafras series. They contain more sand and less silt and clay in the Bt horizon than any of these soils. In addition, they have a thinner solum than Kempsville and Norfolk soils.

Rumford soils are near Kempsville, Norfolk, and Sassafras soils.

Rumford loamy sand, 0 to 10 percent slopes (RrC).—This soil is on rather broad, weakly convex ridges and side slopes.

Included with this soil in mapping are small areas of well-drained Kempsville and Norfolk soils. Also included are small areas of gravelly soils.

Runoff is slow to medium on this soil, and the soil is slightly droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight to moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIs–1; woodland suitability group 3o1.

Ruston Series

The Ruston series consists of deep, well-drained, nearly level to sloping soils that have a thick loamy subsoil. These soils formed in Coastal Plains sediments.

In a representative profile the surface layer is fine sandy loam that is grayish brown in the upper part and light yellowish brown in the lower part. It is 11 inches thick. The subsoil is 89 inches thick. The upper 7 inches is strong-brown sandy clay loam, the next 52 inches is yellowish-red light clay loam, and the lower 30 inches is red and reddish-yellow light clay loam. The substratum, at a depth of 100 inches, extends to a depth of 142 inches or more. It is mottled red, gray, and olive-yellow clay loam.

Available water capacity is high in Ruston soils. Reaction is very strongly acid in the subsoil, and permeability is moderate.

Representative profile of Ruston fine sandy loam, 0 to 2 percent slopes, one-eighth mile north of the intersection of Mechanicsville Turnpike and Laburnum Avenue, 250 feet north of Laburnum Avenue, and 100 feet east of Harris Avenue:

Ap—0 to 8 inches, grayish-brown (2.5Y 5/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; few medium and common fine roots; very strongly acid; abrupt, smooth boundary.

A2—8 to 11 inches, light yellowish-brown (10YR 6/4) fine sandy loam; few fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, granular structure; friable, nonsticky and nonplastic; common fine roots; very strongly acid; clear, smooth boundary.

B1t—11 to 18 inches, strong-brown (7.5YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common fine roots; few thin patchy clay films; very strongly acid; clear, smooth boundary.

B2t—18 to 70 inches, yellowish-red (5YR 5/6) light clay loam; moderate, medium and coarse, angular blocky structure; friable, slightly sticky and nonplastic; few small rounded pebbles; thin continuous clay films; very strongly acid; gradual, smooth boundary.

B3t—70 to 100 inches, red (10R 5/6) and reddish-yellow (7.5YR 6/6) light clay loam; weak, coarse, angular blocky structure; friable, slightly sticky and nonplastic; thin patchy clay films; very strongly acid; gradual, smooth boundary.

C—100 to 142 inches, mottled, red (10R 4/6), gray (10YR 6/1), and olive-yellow (2.5Y 6/6) clay loam; massive; firm, slightly sticky and slightly plastic; very strongly acid.

The solum ranges from about 90 to 114 inches in thickness. Depth to bedrock is more than 5 feet. Fine rounded quartz pebbles often are in one or more of the horizons. These pepples range from less than 1 percent to about 10 percent, by volume, of the soil material.

In the Ap horizon hue is 2.5Y and 10YR, value is 4 or 5, and chroma is 2 to 4. In the A2 horizon value is 5 or 6, and chroma is 3 to 6. The A horizon is fine sandy loam or sandy loam.

In the B1t horizon, where present, chroma is 6 to 8. The B2t horizon is generally yellowish red (5YR 5/6 and 5/8 or 5YR 4/6 and 4/8). The B3t horizon is commonly mottled in red (10R 5/6) and reddish yellow (7.5YR 6/6) but ranges to yellowish red. The B3t horizon is commonly light clay loam but ranges from clay loam to sandy clay loam.

The C horizon ranges from clay loam to sandy loam.

Ruston soils are similar to soils in the Faceville, Norfolk, and Sassafras series. They have a less clayey subsoil than Faceville soils. They have a redder subsoil than Norfolk soils and a thicker solum than Sassafras soils.

Ruston soils are near Faceville, Norfolk, and Sassafras soils.

Ruston fine sandy loam, 0 to 2 percent slopes (RuA).—This soil is on broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Faceville and Norfolk soils. Also included are small areas of soils that have a surface layer of fine sandy loam more than 20 inches thick.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The

soil is friable and is easily tilled. The hazard of erosion is slight.

Most of the acreage of this soil is used for cultivated crops or pasture, and a few small areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 2o1.

Ruston fine sandy loam, 2 to 6 percent slopes (RuB).—This soil is on weakly convex ridges. In a few places the surface layer is slightly thinner than the one described as representative of the series.

Included with this soil in mapping are small areas of well-drained Faceville and Norfolk soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is used for cultivated crops or pasture, and small areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 2o1.

Ruston fine sandy loam, 6 to 10 percent slopes, eroded (RuC2).—This soil is on side slopes. The surface layer is somewhat thinner than the one described as representative of the series. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of well-drained Faceville and Norfolk soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 2o1.

Sassafras Series

The Sassafras series consists of deep, well-drained, nearly level to gently sloping soils that have a loamy subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is brown fine sandy loam 16 inches thick. The subsoil is 54 inches thick. The upper 5 inches is brown heavy fine sandy loam. The next 12 inches is brown light sandy clay loam. The lower 37 inches is yellowish-red heavy fine sandy loam and strong-brown fine sandy loam. The substratum, at a depth of 70 inches, extends to a depth of 80 inches, or more. It is yellowish-brown gravelly sandy clay loam.

Available water capacity is medium in Sassafras soils. Reaction is very strongly acid to medium acid in the subsoil, and permeability is moderate.

Representative profile of Sassafras fine sandy loam, 0 to 2 percent slopes, just north of East Highland Park, 600 feet northwest of Kawneer Drive and Ferebee Street, and 300 feet south of the Chickahominy Scarp:

Ap—0 to 10 inches, brown (10YR 4/3) fine sandy loam; moderate, medium, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; few small rounded pebbles; very strongly acid; abrupt, smooth boundary.

A2—10 to 16 inches, brown (7.5YR 4/4) fine sandy loam; moderate, medium, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; few small rounded pebbles; very strongly acid; clear, smooth boundary.

B1t—16 to 21 inches, brown (7.5YR 4/4) heavy fine sandy loam; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; common medium and fine roots; few medium and fine pores; few small rounded pebbles; thin clay coatings on sand grains and bridging of sand grains; very strongly acid; gradual, smooth boundary.

B21t—21 to 33 inches, brown (7.5YR 4/4) light sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common medium and fine roots; few medium and fine pores; few small rounded pebbles; thin patchy clay films; medium acid; gradual, smooth boundary.

B22t—33 to 38 inches, yellowish-red (5YR 5/8) heavy fine sandy loam; weak, medium, subangular blocky structure; friable, nonsticky and nonplastic; few medium and fine roots; few fine pores; few small rounded pebbles; thin clay coatings on sand grains and bridging of sand grains; strongly acid; gradual, smooth boundary.

B3—38 to 70 inches, strong-brown (7.5YR 5/6) fine sandy loam; few medium, distinct, pale-brown (10YR 6/3) mottles; weak, fine, subangular blocky structure parting to single grained; friable, nonsticky and nonplastic; few small rounded pebbles; sand grains partly coated with clay, common bridging of sand grains; medium acid; gradual, smooth boundary.

C—70 to 80 inches, yellowish-brown (10YR 5/6) gravelly sandy clay loam; massive; friable, slightly sticky and nonplastic; medium acid.

The solum ranges from about 54 to 85 inches in thickness. Depth to bedrock is more than 5 feet. Fine rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 10 percent, by volume, of the soil material.

In the A horizon hue is 10YR and 7.5YR, value is 4 to 6, and chroma is 3 and 4. The A horizon is fine sandy loam or sandy loam.

In the Bt horizon hue is 7.5YR and 5YR, value is 4 or 5, and chroma is 4 to 8. The Bt horizon ranges from heavy fine sandy loam to sandy clay loam. Colors of the B3 horizon are commonly the same as those of the Bt horizon, but pale-brown or light yellowish-brown mottles often are present. The B3 horizon ranges from heavy fine sandy loam and fine sandy loam to sandy loam.

The C horizon ranges from strong-brown to yellowish-brown gravelly sandy clay loam to loamy fine sand and loamy sand.

Sassafras soils in this survey area have slightly higher soil temperatures than Sassafras soils in other survey areas. This, however, does not alter their usefulness or management.

Sassafras soils are similar to soils in the Kalmia, Kempsville, Rumford, and Ruston series. They have a thicker solum and the subsoil is not as yellow as the subsoil of Kalmia and Kempsville soils. They have a thicker solum and contain more silt and clay in the subsoil than Rumford soils. They contain more sand in the subsoil and are not as red in the lower part of the subsoil as Ruston soils.

Sassafras soils are near Kempsville, Norfolk, Rumford, Ruston, and Tetotum soils. They have a thinner solum than Norfolk soils and the subsoil is not as yellow. They are better drained than Tetotum soils and do not have gray mottles in the subsoil.

Sassafras fine sandy loam, 0 to 2 percent slopes (SsA).—This soil is on broad ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Kempsville and Ruston soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops or pasture, and small areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Sassafras fine sandy loam, 2 to 6 percent slopes (SsB).—This soil is on broad, slightly convex ridges. In a few places the surface layer is slightly thinner than the one described as representative of the series.

Included with this soil in mapping are small areas of well-drained Kempsville and Ruston soils. Also included are small areas of gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is used for cultivated crops or pasture, and small areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

State Series

The State series consists of deep, well-drained, nearly level to sloping soils that have a loamy subsoil. These soils formed in alluvium on high river terraces.

In a representative profile the surface layer is yellowish-brown fine sandy loam 11 inches thick. The subsoil is 49 inches thick. The upper 37 inches is yellowish-brown and strong-brown sandy clay loam and clay loam. The lower 12 inches is strong-brown sandy clay loam that has yellowish-red, grayish-brown, brownish-yellow, and light-gray mottles throughout. The substratum, at a depth of 60 inches, extends to a depth of 104 inches or more. It is light-gray, yellow, and red clay.

Available water capacity is high in State soils. Reaction is very strongly acid in the subsoil, and permeability is moderate in the upper 60 inches.

Representative profile of State fine sandy loam, clayey substratum, 2 to 6 percent slopes, 1 mile north of West Broad Street Road, one-fourth mile north of Parham Road, and 500 feet east of Hungary Springs Road:

Ap—0 to 11 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common fine roots; few rounded pebbles; few fine flakes of mica; very strongly acid; abrupt, smooth boundary.

B1t—11 to 20 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common fine roots; few fine pores; few rounded pebbles; few thin patchy clay films; few fine flakes of mica; very strongly acid; clear, smooth boundary.

B21t—20 to 31 inches, strong-brown (7.5YR 5/6) clay loam; weak, medium, subangular blocky structure; friable, sticky and slightly plastic; few fine roots; few fine pores; thin patchy clay films; few fine flakes of mica; very strongly acid; gradual, smooth boundary.

B22t—31 to 48 inches, strong-brown (7.5YR 5/8) clay loam; common medium, distinct, yellowish-red (5YR 4/8) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; few rounded pebbles; thin patchy clay films; few fine flakes of mica; very strongly acid; gradual, smooth boundary.

B23t—48 to 55 inches, strong-brown (7.5YR 5/6) sandy clay loam; common medium, distinct, red (2.5YR 4/6) and grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; friable, slightly sticky and slightly plastic; few fine pores; few rounded pebbles; few fine flakes of mica; very strongly acid; gradual, smooth boundary.

B3t—55 to 60 inches, mottled, brownish-yellow (10YR 6/8), reddish-brown (2.5YR 4/4), and light-gray (10YR 7/1) sandy clay loam; weak, coarse, angular blocky structure; friable, slightly sticky and slightly plastic; common rounded pebbles; thin patchy clay films; few fine flakes of mica; very strongly acid; gradual, smooth boundary.

IIC—60 to 104 inches, mottled, light-gray (10YR 7/1), yellow (10YR 7/8), and red (10R 4/8) clay; massive; firm, sticky and plastic; few mica flakes; very strongly acid.

The solum ranges from 48 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 10 percent, by volume. Some sola are gravelly.

In the A horizon hue is 10YR and 2.5Y, value is 4 or 5, and chroma is 2 to 4.The A horizon is fine sandy loam, sandy loam, and loam.

In the Bt horizon hue is 7.5YR and 10YR, value is 4 or 5, and chroma is 4 to 8. The lower Bt horizon has yellowish-red, red, and grayish-brown mottles. The B3t horizon commonly contains strong-brown, yellowish-brown, brownish-yellow, yellowish-red, red, and gray mottles. The Bt horizon is commonly sandy clay loam and clay loam.

The C horizon contains brown, yellow, red, and gray mottles and is commonly clay but ranges from clay to sandy loam and is occasionally gravelly or very gravelly.

State soils are similar to soils in the Appling, Pamunkey, and Turbeville series. They have less clayey Bt horizons than Appling and Turbeville soils and do not have the red colors that are characteristic of Turbeville soils. They have a yellower solum than Pamunkey soils.

State soils are near Appling, Bourne, Cecil, Ruston, and Turbeville soils. They do not have the fragipan that is characteristic of Bourne soils and have less clayey, yellower Bt horizons than Cecil soils. They have a yellower solum than Ruston soils.

State fine sandy loam, clayey substratum, 0 to 2 percent slopes (StA).—This soil is on rather broad ridges.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and small areas of well-drained Turbeville soils. Also included are small areas of gravelly soils and small areas of soils that have a clayey subsoil.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is slight.

Most of the acreage of this soil is used for cultivated crops and pasture, and some small areas are

wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

State fine sandy loam, clayey substratum, 2 to 6 percent slopes (StB).—This soil is on rather broad ridges and side slopes. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and small areas of well-drained Turbeville soils. Also included are small areas of gravelly soils and small areas of soils that have a clayey subsoil.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is used for cultivated crops and pasture, and some areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded (StC2).—This soil is on side slopes. In a few places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and small areas of gravelly soils and small areas of soils that have a clayey subsoil.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the other half is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes (SvB).—This soil is on ridges. It has 15 to 25 percent fine, rounded quartz pebbles in the surface layer and subsoil.

Included with this soil in mapping are small areas of moderately well drained Bourne soils and small areas of well-drained Turbeville soils. Also included are small areas of very gravelly soils and small areas of soils that have a clayey subsoil.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable, but the gravel content of the surface layer interferes with tillage. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops and pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Tetotum Series

The Tetotum series consists of deep, moderately well drained, nearly level and gently sloping soils that have a loamy subsoil. These soils formed in Coastal Plain sediments.

In a representative profile the surface layer is dark grayish-brown fine sandy loam 8 inches thick. The subsoil is 42 inches thick. The upper 26 inches is yellowish-brown fine sandy loam and sandy clay loam. Light-gray mottles are at a depth of about 24 inches and lower. The lower 16 inches is gray and olive-yellow sandy clay loam. The substratum, at a depth of 50 inches, extends to a depth of 93 inches or more. It is gray, red, and olive-yellow sandy clay loam.

Available water capacity is medium in Tetotum soils. Reaction is very strongly acid in the subsoil, and permeability is moderate. A seasonal high water table is at a depth of 1 to 1½ feet in winter and early in spring.

Representative profile of Tetotum fine sandy loam, just south of Creighton Road, between Laburnum Avenue and Dabbs House Road, in an urban area at the eastern edge of the city of Richmond:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common fine roots; few small, rounded pebbles; medium acid; abrupt, smooth boundary.

B1t—8 to 16 inches, yellowish-brown (10YR 5/6) heavy fine sandy loam; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few fine roots; few medium and fine pores; few small, rounded pebbles; few thin, patchy clay films; very strongly acid; clear, smooth boundary.

B21t—16 to 24 inches, yellowish-brown (10YR 5/6) sandy clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; few medium and fine pores; few small, rounded pebbles; thin, patchy clay films; very strongly acid; clear, smooth boundary.

B22t—24 to 34 inches, yellowish-brown (10YR 5/8) light sandy clay loam; common medium, distinct, gray (10YR 6/1) mottles; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; few small rounded pebbles; thin, patchy clay films; very strongly acid; clear, smooth boundary.

B3tg—34 to 50 inches, mottled, gray (N 6/0) and olive-yellow (2.5Y 6/6) sandy clay loam; weak, thick, platy structure that parts to weak, medium, angular blocky structure; friable, nonsticky and nonplastic; few small rounded pebbles; few thin, patchy clay films; very strongly acid; gradual, smooth boundary.

C—50 to 93 inches, mottled, gray, red, and olive-yellow sandy clay loam; massive; friable, nonsticky and nonplastic; very strongly acid.

The solum ranges from about 40 to 60 inches in thickness. Depth to bedrock is more than 5 feet. Fine, rounded quartz pebbles commonly are throughout the solum, ranging from less than 1 percent to about 15 percent, by volume.

In the Ap and A1 horizons, hue is 10YR and 2.5Y, value is 4 or 5, and chroma is 2 and 3.

In the Bt horizon hue is 10YR and in places is 7.5YR and 2.5Y, value is 4 or 5, and chroma is 4 to 8. Mottles of chroma 2 or less are within the upper 24 inches of the Bt horizon. The Bt horizon ranges from sandy clay loam and light sandy clay loam to clay loam. The B3tg horizons have gray, olive-yellow, yellowish-brown, and olive-brown mottles.

The C horizon ranges from sandy clay loam to loamy sand and has gray, red, olive-yellow, yellowish-brown, and olive-brown mottles.

Tetotum soils are similar to soils in the Altavista, Angie, and Bertie series. They do not have the mica flakes in the subsoil that are characteristic of Altavista and Bertie soils. They are better drained than Bertie soils. They have a thinner and less clayey solum than Angie soils.

Tetotum soils are near Atlee, Bourne, Kempsville, and Lynchburg soils. They do not have the fragipan that is characteristic of Atlee and Bourne soils. They are less well drained than Kempsville soils, which do not have gray mottles in the solum. They are better drained and have a thinner solum than Lynchburg soils.

Tetotum fine sandy loam (Te).—This nearly level soil is on broad upland flats. Slopes are dominantly 0 to 2 percent. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of somewhat poorly drained Lynchburg soils and well-drained Norfolk soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. Drainage is desirable if the soil is used for farming. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half of the acreage of this soil is used for cultivated crops or pasture, and most of the other half is wooded. This soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess wetness. Capability unit IIw–2; woodland suitability group 3o1.

Tetotum loam, flooded (Td).—This nearly level to gently sloping soil is along drainageways, on foot slopes, and on small areas at the heads of drainageways. Slopes are dominantly 0 to 6 percent.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. A seasonal high water table is at depths of 1 to 2 feet, and drainage is desirable if the soil is used for farming. The soil is occasionally flooded. The soil is friable and is easily tilled. The hazard of erosion is slight.

About half of the acreage of this soil is used for cultivated crops and pasture, and most of the other half is wooded. The soil is suited to most crops commonly grown in the county, except for those that are sensitive to excess moisture. Capability unit IIw–1; woodland suitability group 3o1.

Toccoa Series

The Toccoa series consists of deep, well-drained, nearly level soils that have a dominantly loamy substratum. These soils formed in alluvium on flood plains.

In a representative profile the surface layer is fine sandy loam that is dark grayish brown in the upper part and dark yellowish brown in the lower part. It is 15 inches thick. The upper part of the substratum is dark reddish-brown very fine sandy loam and fine sandy loam to a depth of 59 inches. The lower part extends to a depth of 102 inches or more. It is dark yellowish brown fine sandy loam.

Available water capacity is medium in Toccoa soils. Reaction is medium acid to strongly acid in the substratum, and permeability is moderately rapid. A seasonal high water table is at a depth of 4 feet or more, and the soils are frequently flooded.

Representative profile of Toccoa fine sandy loam, one-half mile southwest of Westham, one-half mile west of Huguenot Bridge and State Route 147, and 125 feet north of the James River:

O1—½ inch to 0, partly decomposed leaves and twigs.
A11—0 to 3 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; common fine mica flakes; strongly acid; abrupt, smooth boundary.
A12—3 to 15 inches, dark yellowish-brown (10YR 3/4) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; common fine mica flakes; strongly acid; abrupt, smooth boundary.
C1—15 to 27 inches, dark reddish-brown (5YR 3/4) very fine sandy loam; massive; very friable, nonsticky and nonplastic; thin layers and lenses of brown (7.5YR 4/4) loamy fine sand; common medium and fine roots; common fine mica flakes; medium acid; abrupt, smooth boundary.
C2—27 to 36 inches, dark reddish-brown (5YR 3/3) fine sandy loam; massive; very friable, nonsticky and nonplastic; common fine mica flakes; strongly acid; abrupt, smooth boundary.
C3—36 to 59 inches, dark reddish-brown (5YR 3/4) very fine sandy loam; massive; very friable, slightly sticky and nonplastic; thin layers and lenses of brown (7.5YR 4/4) loamy fine sand and yellowish-red (5YR 4/6) silty clay; common fine mica flakes; medium acid; abrupt, smooth boundary.
C4—59 to 102 inches, dark yellowish-brown (10YR 3/4) fine sandy loam; massive; very friable, nonsticky and nonplastic; changing to firm, sticky, and slightly plastic, brown (10YR 4/3) silty clay in the lower part; common fine mica flakes; strongly acid.

The solum is about 15 inches thick. Depth to bedrock is more than 5 feet. Few to many fine mica flakes are in all horizons.

In the A horizon hue is 10YR and 7.5YR, value is 3 to 5, and chroma is 2 to 4. The A horizon is commonly fine sandy loam but ranges to sandy loam and loamy sand.

In the C horizon hue is 5YR, 7.5YR, and 10YR, value is 3 to 5, and chroma is 3 to 6. The C horizon ranges from fine sandy loam and very fine sandy loam to loamy fine sand and loamy sand. Thin layers and lenses of coarser and finer textures are in some C horizons. Gravelly strata and clayey strata are in some soils below a depth of about 40 inches.

Toccoa soils are similar to soils in the Buncombe, Chewacla, and Riverview series. They contain less sand and more silt and clay than Buncombe soils. They are better drained and less clayey than Chewacla soils and are less clayey than Riverview soils.

Toccoa soils commonly are near Buncombe, Chewacla, Riverview, and Roanoke soils. They are better drained and do not have the clayey Bt horizon that is characteristic of Roanoke soils.

Toccoa fine sandy loam (To).—This nearly level soil is on broad stream flood plains. Slopes are dominantly 0 to 2 percent.

Included with this soil in mapping are small areas of excessively drained Buncombe soils, moderately well drained to somewhat poorly drained Chewacla soils, and well-drained Riverview soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops or pasture, and small areas are wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIw–1; woodland suitability group 1o1.

Turbeville Series

The Turbeville series consists of deep, well-drained, nearly level to sloping soils that have a thick, dominantly clayey subsoil. These soils formed in alluvial materials that are above and some distance from present stream channels.

In a representative profile the surface layer is brown fine sandy loam 7 inches thick. The subsoil is 75 inches thick. The upper 5 inches is yellowish-red sandy clay loam. The lower 70 inches is dark-red clay. The substratum begins at a depth of 82 inches and extends to a depth of 109 inches or more. It is red, brownish-yellow, and light-gray clay.

Available water capacity is medium in Turbeville soils. Reaction is very strongly acid to strongly acid in the subsoil, and permeability is moderate.

Representative profile of Turbeville fine sandy loam, 2 to 6 percent slopes, on Grantland Estate, one-eighth mile east of Roslyn Episcopal Estate, one-fourth mile west of Westham Creek, and one-eighth mile south of River Road:

O1—1 inch to 0, partly decomposed pine needles, leaves, and twigs.

Ap—0 to 7 inches, brown (7.5YR 4/2) fine sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; common medium and fine roots; few rounded pebbles; very strongly acid; abrupt, smooth boundary.

B1t—7 to 12 inches, yellowish-red (5YR 5/6) sandy clay loam, reddish yellow (5YR 6/6) when dry; weak, medium, subangular blocky structure; friable, slightly sticky and nonplastic; common medium and fine roots; few fine pores; few rounded pebbles; thin patchy clay films; strongly acid; clear, smooth boundary.

B2t—12 to 56 inches, dark-red (10R 3/6) clay, red (10R 5/6) when dry; moderate, medium, angular blocky structure; firm, sticky and plastic; few medium and common fine roots; few medium and fine pores; few rounded pebbles; thin, continuous clay films; very strongly acid; gradual, smooth boundary.

B3t—56 to 82 inches, dark-red (10R 3/6) clay, red (10R 5/6) when dry; moderate, medium and coarse subangular blocky structure; firm, sticky and plastic; few medium and fine roots; few rounded pebbles; thin patchy clay films; very strongly acid; gradual, smooth boundary.

C—82 to 109 inches, red (10R 4/6), brownish-yellow (10YR 6/8), and light-gray (2.5Y 7/2) clay; massive; firm, sticky and plastic; few rounded pebbles; very strongly acid.

The solum ranges from about 66 to 102 inches in thickness. Depth to hard bedrock is more than 5 feet. Fine rounded quartz pebbles commonly are throughout the solum and substratum, ranging from less than 1 percent to about 25 percent, by volume.

In the A horizon hue is 7.5YR and 10YR, value is 4 or 5, and chroma is 2 and 3. The A horizon ranges from fine sandy loam and sandy loam to gravelly fine sandy loam and gravelly sandy loam. It is clay loam in severely eroded areas.

The B1t horizon is commonly yellowish red or strong brown when moist and changes to reddish yellow when dry. The B1t horizon ranges from sandy clay loam and clay loam to gravelly sandy clay loam and gravelly loam. When the B2t and B3t horizons are moist, hue is 10R and 2.5YR, value is 3 or 4, and chroma is 4 to 8. When they are dry, value is commonly 5 and 6. The B2t and B3t horizons range from clay and heavy clay loam to gravelly clay and gravelly heavy clay loam.

The C horizon ranges from clay and clay loam to gravelly clay and gravelly clay loam.

Turbeville soils are similar to soils in the Caroline, Faceville, and Ruston series. They have a redder subsoil than Caroline soils. They have mixed mineralogy, while Faceville soils have kaolinitic mineralogy. They have a redder and more clayey subsoil than Ruston soils.

Turbeville soils are near Appling, Bourne, Creedmoor, Faceville, Kempsville, and Mayodan soils. They have a thicker solum than all of these soils. They are better drained and redder than Creedmoor soils. In addition, they have redder Bt horizons than Appling soils and do not have the fragipan that is characteristic of Bourne soils. They have redder, more clayey Bt horizons than Kempsville soils and contain less silt than Mayodan soils.

Turbeville fine sandy loam, 0 to 2 percent slopes (TuA).—This soil is on broad, high terraces. The surface layer is thicker than the one described as representative of the series, commonly ranging from 8 to 12 inches.

Included with this soil in mapping are small areas of well-drained Kempsville soils. Also included are small areas of gravelly soils.

Runoff is slow on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled.

About half of the acreage of this soil is used for cultivated crops or pasture, and the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit I–1; woodland suitability group 3o1.

Turbeville fine sandy loam, 2 to 6 percent slopes (TuB).—This soil is on somewhat broad, slightly convex ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of well-drained Kempsville soils. Also included are small areas of gravelly soil.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About half of the acreage of this soil is used for cultivated crops or pasture, and the other half is wooded. This soil is well suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Turbeville fine sandy loam, 6 to 10 percent slopes, eroded (TuC2).—This soil is on side slopes. The surface layer and the entire profile are slightly thinner than the ones described as representative of the series. In some places, where plowing has mixed the upper part of the subsoil into the surface layer, the surface layer is sandy clay loam.

Included with this soil in mapping are small areas of well-drained Appling, Cecil, and Kempsville soils. Also included are small areas of gravelly soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions.

The soil is friable and is easily tilled. The hazard of further erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Turbeville gravelly fine sandy loam, 2 to 6 percent slopes (TvB).—This soil is on slightly convex ridges and side slopes. The surface layer has 15 to 25 percent, by volume, of rounded quartz pebbles. In many places the subsoil also is gravelly.

Included with this soil in mapping are small areas of well-drained Kempsville soils. Also included are small areas of very gravelly soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable, but the pebbles damage tillage equipment. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops or pasture. This soil is suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Turbeville gravelly fine sandy loam, 6 to 10 percent slopes (TvC).—This soil is on side slopes. The surface layer has 15 to 25 percent, by volume, of rounded quartz pebbles. In many places the subsoil also is gravelly.

Included with this soil in mapping are small areas of well-drained Kempsville soils. Also included are small areas of very gravelly soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable, but the pebbles damage tillage equipment. The hazard of erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

Most of the acreage of this soil is wooded, but small areas are used for cultivated crops or pasture. This soil has limited suitability for most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Udorthents

Udorthents consists of nearly level to gently sloping, well-drained to somewhat poorly drained, loamy and clayey soil materials in areas of cut land, fill, and hydraulic fill. These areas are scattered over Henrico County, but they are more closely associated with urban development and channel dredging in the tidal part of the James River.

Udorthents commonly range from sandy loam to clay but include some loamy sands and some gravelly soil material. Reaction ranges from medium acid to very strongly acid, and permeability is moderate to slow. A seasonal high water table ranges from a depth of about 1 foot to a depth of 4 feet or more. Some of the nearly level soil material is ponded in wet seasons.

Udorthents, clayey (UD).—This mapping unit consists of soil material in areas of cut land that have been cut several feet or more into clayey soil material. These areas are commonly moderately well drained to somewhat poorly drained. Slopes are dominantly 0 to 6 percent.

Included with Udorthents, clayey, in mapping are small areas of Appling, Caroline, Cecil, Creedmoor, Duplin, Mayodan, and Turbeville soils.

Runoff is slow to medium on this soil material. The hazard of erosion is severe in areas of gently sloping soil material if it is left without plant cover. Capability unit unclassified; woodland suitability group unclassified.

Udorthents, loamy (UE).—This mapping unit consists of soil material in areas of cut land that have been cut several feet or more into loamy soil material and in areas of fill and hydraulic fill where the loamy fill materials are several feet deep or more. This soil material ranges from clay loam and gravelly clay loam to loam and sandy loam. These areas are commonly well drained to somewhat poorly drained. Slopes are dominantly 0 to 6 percent.

Included with Udorthents, loamy, in mapping are small areas of Altavista, Angie, Atlee, Bourne, Chewacla, Duplin, Kempsville, Kinston, Norfolk, Pamunkey, State, and Turbeville soils. Also included are small areas of clayey and loamy sand fill and small areas of sloping fill.

Runoff is slow to medium on this soil material. The hazard of erosion is severe in areas of gently sloping soil material if it is left without plant cover. Capability unit unclassified; woodland suitability group unclassified.

Urban Land

Urban land (UR) is land that has been so altered or obscured by urban works, structures, paving, and earth moving that classification of soils is not feasible. Included in this mapping unit are areas of land used intensively for housing, for shopping centers, for parking lots, for warehouses, for industrial construction, and for other concentrated development. Capability unit unclassified; woodland suitability group unclassified.

Wedowee Series

The Wedowee series consists of deep, well-drained, gently sloping to sloping soils that have a loamy to clayey subsoil. These soils formed in material weathered from granite and gneiss.

In a representative profile the surface layer is 9 inches thick. It is sandy loam that is dark gray in the upper part and pale brown in the lower part. The subsoil is 24 inches thick. The upper 6 inches is brown light clay loam. The lower 18 inches is strong-brown heavy clay loam. The substratum begins at a depth of 33 inches and extends to a depth of 91 inches or more. It is sandy clay loam in the upper part and heavy clay

loam in the lower part and has red, yellow, reddish-yellow, and light-gray mottles.

Available water capacity is high in Wedowee soils. Reaction is very strongly acid in the subsoil, and permeability is moderate.

Representative profile of Wedowee sandy loam, 2 to 6 percent slopes, 2 miles south of Short Pump and 60 feet east of Pump Road:

O1—1 inch to 0, partly decomposed leaves and twigs.
A1—0 to 1 inches, dark-gray (10YR 4/1) sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many medium and fine roots; very strongly acid; abrupt, smooth boundary.
A2—1 to 9 inches, pale-brown (10YR 6/3) sandy loam; weak, fine, granular structure; very friable, nonsticky and nonplastic; many large, medium, and fine roots; very strongly acid; clear, smooth boundary.
B1t—9 to 15 inches, brown (7.5YR 4/4) light clay loam; weak, medium, subangular blocky structure; friable, slightly sticky and slightly plastic; common medium and fine roots; few fine pores; few thin, patchy clay films; very strongly acid; clear, smooth boundary.
B2t—15 to 33 inches, strong-brown (7.5YR 5/6) heavy clay loam; weak, medium, subangular blocky structure; firm, slightly sticky and slightly plastic; common medium and fine roots; few fine pores; thin patchy clay films; very strongly acid; clear, smooth boundary.
C1—33 to 42 inches, mottled, red (2.5YR 4/8), yellow (10YR 7/8), and light-gray (10YR 7/1) sandy clay loam; massive, friable, slightly sticky and nonplastic; few fine roots; lenses of reddish-brown (5YR 4/4) clay; very strongly acid; clear, smooth boundary.
C2—42 to 91 inches, mottled, reddish-yellow (5YR 6/8), light-gray (2.5Y 7/2) and red (10R 4/8) heavy clay loam; massive; firm, slightly sticky and slightly plastic; small pockets of dark-brown (7.5YR 4/4) clay; very strongly acid.

The solum ranges from about 24 to 40 inches in thickness. Depth to bedrock is more than 5 feet.

In the A1 and Ap horizons, hue is 10YR, value is 4 to 6, and chroma is 1 to 4. Chromas of the A2 horizon are 3 and 4. The A2 horizon is sandy loam or fine sandy loam.

In the Bt horizon hue is 7.5YR and 10YR, value is 4 or 5, and chroma is 4 to 8. The B1t horizon ranges from loam to clay loam. The B2t horizon ranges from heavy clay loam to clay.

The C horizon has red, yellowish-red, reddish-yellow, yellow, strong-brown, light-gray, and gray mottles. The C horizon ranges from sandy clay loam to heavy clay loam.

Wedowee soils are similar to soils in the Appling, Cecil, and Mayodan series. They have a thinner solum than all of these soils. In addition, the Cecil and Mayodan soils have redder B2t horizons.

Wedowee soils commonly are near Appling, Ashlar, and Cecil soils. They are more clayey than Ashlar soils and have Bt horizons, which Ashlar soils do not have.

Wedowee sandy loam, 2 to 6 percent slopes (WeB).—This soil is on rather narrow, slightly convex ridges. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of moderately well drained Bourne and Helena soils.

Runoff is medium on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is moderate if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fourth of the acreage of this soil is used for cultivated crops or pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIe–1; woodland suitability group 3o1.

Wedowee sandy loam, 6 to 15 percent slopes (WeD).—This soil is on side slopes.

Included with this soil in mapping are small areas of moderately well drained Bourne and Helena soils.

Runoff is medium to rapid on this soil, and the soil is not droughty under prevailing climatic conditions. The soil is friable and is easily tilled. The hazard of erosion is severe if the soil is disturbed and left without plant cover or is used for clean-tilled crops.

About one-fifth of the acreage of this soil is used for cultivated crops and pasture, and most of the rest is wooded. This soil is suited to most crops commonly grown in the county. Capability unit IIIe–1; woodland suitability group 3o1.

Use and Management of the Soils

This section discusses management of the soils for crops and pasture and gives facts about woodland and wildlife in the county. It also describes use of the soils for engineering and for town and country planning.

Management of Soils for Crops and Pasture

In the pages that follow, some basic practices of soil management for crops and pasture are discussed. The capability classification system used by the Soil Conservation Service is explained, and use and management of the soils in each capability unit are discussed. Finally, estimated yields of the commonly grown crops when a high level of management is used are given.

Maintaining soil fertility.—Many of the soils in Henrico County are highly leached and consequently are strongly acid and generally low in essential plant nutrients. Crops and pasture plants on most of the soils respond well to the application of lime and fertilizer. The amount of lime and fertilizer to be applied to any individual area depends on past cropping history, on the type of soil, on the crops to be grown, and on the yield desired. The amount applied should be based largely on the results of laboratory analysis of soil samples. Information and instruction for collecting soil samples and for having them tested can be obtained from the nearest Soil Conservation Service Office or Extension Agent.

Maintaining soil structure.—Excessive tillage tends to destroy the soil structure. This in turn generally lowers the infiltration rate of the soil and results in less favorable tilth of the seedbed. Essential tillage should be confined to the period of optimum moisture content of each soil in order to help prevent formation of clods or conditions leading to crusting. This is especially important on moderately eroded or severely eroded soils, because the plow layer of these soils generally has more clay than similar, uneroded soils. Tillage should be limited to the minimum amount necessary for the preparation of a seedbed and for the

control of weeds. Cropping systems that utilize close-growing crops or grass and legume crops in rotation with row crops help to prevent deterioration of soil structure through excessive tillage. Soil compaction and deterioration of soil structure also results if wet soils are trampled by livestock. Soil compaction results in increased surface runoff and a less favorable root zone for pasture plants.

Controlling erosion.—Soils in capability subclasses IIe, IIIe, IVe, VIe, and VIIe are subject to water erosion. The control of erosion on these soils is a major management principle for farmers in the county if farming is to be a sustained land use practice. Farming has declined in the county partly because of losses from erosion. Practices presently used in the county to help control erosion on cropland and pasture include contour stripcropping, terraces or diversions, grassed waterways, the use of crop residues, minimum tillage, permanent grass or vegetation, and cropping systems that use grass or close-growing crops in rotation with row crops. The kinds of practices to be used on any area depend primarily on the needs of the farmer and in the kinds of soil to be used. Assistance for the control of erosion for any tract of land can be obtained from the District Conservationist at the local Soil Conservation Service Office.

Drainage.—Excessive soil wetness is at least a seasonal problem on the soils in capability subclasses IIw, IIIw, IVw, VIw, and VIIw. The soils in capability subclasses IIw, IIIw, and IVw can normally be artificially drained, but with increasing difficulty on the soils in capability subclasses IIIw and IVw. These soils are generally drained by surface ditches, tile drains, or by a combination of these two systems. Crops and pasture plants on these soils generally improve as a result of adequate drainage. The soils in capability units VIw and VIIw are not commonly drained for crops or pasture. Soils such as Bourne, Colfax, or Helena soils that have either a fragipan or a clayey subsoil drain slowly when only tile drains are used.

Choosing a cropping system.—The choice of an appropriate cropping system is a major management principle for farmers in the county. All of the soils in the county have physical and chemical characteristics that affect their potential for use for farming. A cropping system should be used that (1) does not exceed a tolerable soil erosion loss for the soils involved, and (2) meets the needs of the farmer consistent with the capability of the soils. Cropping systems range from continuous row crops to various kinds of rotation to permanent grass or vegetation. Assistance in choosing an appropriate cropping system can be obtained from the District Conservationist of the Soil Conservation Service.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for trees or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife. (None in Henrico County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. (None in Henrico County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or

no erosion, although they have other limitations that restrict their use largely to pasture, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The capability units in Henrico County are described in this part of the survey. The names of soil series represented are mentioned in the description of each capability unit, but this does not mean that all the soils of a given series appear in that unit. To find the capability classification of any given mapping unit, refer to the "Guide to Mapping Units" at the back of this survey.

Each capability unit description indicates the general characteristics or qualities of the soils in the unit, their suitability for crops, and the major limitations or hazards to use for crops and pasture. It is not within the scope of this survey to present detailed management recommendations. There are, for example, many different combinations of cropping systems and erosion-control practices that can control erosion. The selection of management practices can vary from farm to farm, but all may effectively control erosion. Assistance in planning appropriate cropping systems, erosion control, selection of proper plant varieties, artificial drainage, and other aspects of farm management can be obtained from the District Conservationist at the local Soil Conservation Service Office, or from the local Extension Agent.

CAPABILITY UNIT I–1

This unit consists of deep, well-drained, nearly level soils of the Faceville, Kempsville, Norfolk, Pamunkey, Ruston, Sassafras, State, and Turbeville series. These soils are not eroded or are only slightly eroded. They are either on uplands or on stream terraces that normally are above flood level.

The soils in this unit have a friable surface layer. They have a dominantly sandy clay loam or clay loam subsoil except for the Turbeville soil, which has a clayey subsoil. Permeability is moderate. Available water capacity is medium to high, and the rooting zone is deep. Reaction, except in limed areas, is slightly acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is slow. The hazard of erosion is slight if the soils are cultivated or if the pasture vegetation is thin.

These soils are well suited to the commonly grown field crops (fig. 4), hay, and pasture plants. They are well suited to row crops and to sprinkler irrigation.

CAPABILITY UNIT IIe–1

This unit consists of deep, well-drained, gently sloping soils of the Appling, Caroline, Faceville, Kempsville, Mayodan, Norfolk, Pamunkey, Ruston, Sassafras, State, Turbeville, and Wedowee series. These soils are slightly eroded to moderately eroded. They are either on uplands or on stream terraces that generally are above flood level.

The soils in this unit have a friable and erodible plow layer but the Kempsville, Norfolk, Pamunkey, and State soils are somewhat less susceptible to erosion than the other soils. The Appling, Caroline, Mayodan, and Turbeville soils have a clayey subsoil. The other soils have a subsoil of dominantly sandy clay loam or clay loam. Permeability is moderate in all of the soils, except in the Caroline soils, where permeability is moderately slow. Available water capacity is medium to high, and the rooting zone is deep. Reaction, except in limed areas, is slightly acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet, except in the Mayodan soil, where bedrock is at a depth of 4 feet or more. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is medium. The hazard of erosion is moderate if the soils are cultivated or if the pasture vegetation is thin (fig. 5).

These soils are suited to the commonly grown field crops, hay, and pasture plants. They are suited to row crops only if the cropping system used helps to control erosion. The soils are suited to sprinkler irrigation if erosion is controlled.

CAPABILITY UNIT IIe–2

This unit consists of deep, moderately well drained, gently sloping soils of the Altavista, Angie, Bourne, and Duplin series. These soils are slightly eroded to moderately eroded. They are either on uplands or on stream terraces that generally are above flood level.

The soils in this unit have an erodible plow layer, but the Altavista soils are somewhat less susceptible to erosion than the other soils. The Altavista and Bourne soils commonly have a sandy clay loam subsoil. Angie and Duplin soils have a dominantly clayey subsoil. Permeability is moderate in Altavista soils, slow in Angie and Duplin soils, and slow to very slow in the fragipan of Bourne soils. Available water capacity in all of the soils is medium, and the rooting zone is deep in all but Bourne soils, which have a moderately deep root zone. Reaction, except in limed areas, is strongly acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. Depth to the fragipan in Bourne soils is 18 to 30 inches. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is medium. The hazard of erosion is moderate if they are cultivated or if the pasture vegetation is thin. In some areas, Altavista and Angie soils receive seepage and surface runoff from

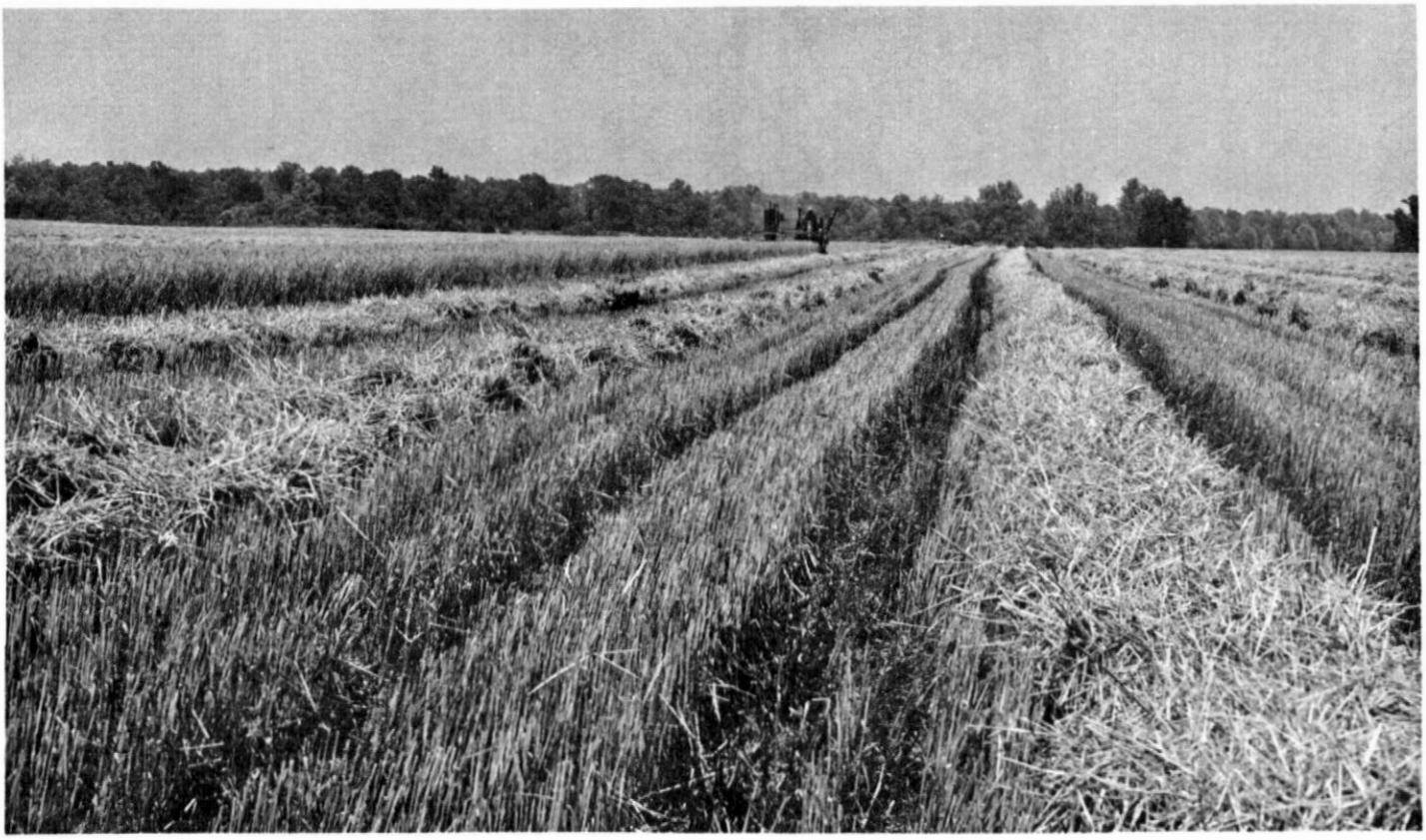

Figure 4.—**Wheat harvest on nearly level Pamunkey sandy loam.**

higher lying areas. Artificial drainage helps alleviate seasonal wetness in these soils.

The soils in this unit are suited to the commonly grown field crops (fig. 6), hay, and pasture plants. Alfalfa is short lived on these soils because of seasonal wetness. These soils are suited to row crop only if the cropping system used helps to control erosion. They are suited to sprinkler irrigation if erosion is controlled.

CAPABILITY UNIT IIe–3

This unit consists of deep, moderately well drained, gently sloping soils of the Creedmoor and Helena series. These soils are slightly eroded. They are on uplands underlain by sandstone and shale or by granite, gneiss, and schist.

The soils in this unit have a friable and erodible plow layer. They have a lower annual tolerable soil loss than most other upland soils in the county. These soils have a dominantly very firm, sticky and plastic clay subsoil. Permeability is slow to very slow. Available water capacity is medium, and the rooting zone is moderately deep. Reaction, except in limed areas, is very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is low to medium.

Runoff on these soils is medium. The hazard of erosion is moderate if the soils are cultivated or if the pasture vegetation is thin.

The soils in this unit are suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short-lived on these soils because of seasonal wetness. Planting is occasionally delayed because the soils dry out slowly. These soils are suited to row crops only if the cropping system used helps to control erosion. They are moderately well suited to sprinkler irrigation.

CAPABILITY UNIT IIw–1

This unit consists of deep, well drained and moderately well drained, nearly level and gently sloping soils of the Abell, Kalmia, Kempsville, Riverview, Tetotum, and Toccoa series. These soils are at the bases of slopes, along drainageways, in depressions, on flood plains and low terraces, and in low-lying areas.

The soils in this unit have a friable plow layer. The subsoil ranges from fine sandy loam, very fine sandy loam, and silt loam to loam, sandy clay loam, and clay loam. Permeability is moderate. Available water capacity is medium to high, and the rooting zone is deep. Reaction, except in limed areas, is medium acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium to high.

Flooding, seepage, and surface runoff from higher laying areas are the principal hazards to farming these soils. Local silting is a problem in some areas. Flooding is common in spring and early in summer

Figure 5.—**The Sassafras fine sandy loam on the right is being prepared for a crop, but the Class VI soils on the left are in permanent pasture.**

and often precludes the growing of high-value crops. Artificial drainage helps alleviate seasonal wetness in the Abell and Tetotum soils.

These soils are suited to summer crops, including truck crops, that can be planted after the normal flooding season. The hazard of erosion is little or none, and row crops can be grown year after year if improved management is used. Pasture and hay plants that can withstand flooding and seasonal wetness are well suited to these soils. The soils are suited to sprinkler irrigation.

CAPABILITY UNIT IIw–2

This unit consists of deep, moderately well drained, nearly level soils of the Altavista, Angie variant, Atlee, Bourne, Duplin, and Tetotum series. They are either on terraces or on uplands that generally are above flood level.

The soils in this unit have a friable plow layer. They have a dominantly sandy clay loam, clay loam, or silty clay loam subsoil, but the Duplin soil has a clayey subsoil. Permeability is moderate to very slow. Available water capacity is medium, and the rooting zone is deep in all but Bourne soils, which have a moderately deep root zone. Reaction, except in limed areas, is strongly acid to very strongly acid in the root zone. The seasonal high water table is at a depth of 1½ to 3½ feet. Depth to bedrock is commonly more than 5 feet. Depth to the fragipan in Bourne soils is 18 to 30 inches. The capacity of these soils to store and release plant nutrients for crop use is medium.

The seasonal high water table is the principal hazard to farming these soils. A few areas of these soils are occasionally flooded or ponded. Artificial drainage helps alleviate seasonal wetness.

These soils are suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived because of seasonal wetness. Planting is occasionally delayed because the soils dry out slowly. The hazard of erosion is little or none, and row crops can be grown year after year if improved management is used. Pasture and hay plants that can withstand seasonal wetness are suited to these soils. The soils are suited to sprinkler irrigation.

CAPABILITY UNIT IIIe–1

This unit consists of deep, well-drained, gently sloping to sloping soils of the Appling, Caroline, Cecil,

Figure 6.—**Wheat ready for harvest on a Duplin very fine sandy loam.**

Kalmia, Kempsville, Norfolk, Pamunkey, Ruston, State, Turbeville, and Wedowee series. These soils are slightly eroded to moderately eroded. They are either on uplands or on stream terraces that generally are above flood level.

The soils in this unit have an erodible plow layer but the Kalmia, Norfolk, and Pamunkey soils are somewhat less susceptible to erosion than the other soils. The Appling, Caroline, Cecil, and Turbeville soils have a clayey subsoil. The other soils have a subsoil of dominantly sandy clay loam or clay loam. Permeability is moderate in all of these soils except in the Caroline soil, where it is moderately slow. Available water capacity is medium to high, and the rooting zone is deep. Reaction, except in limed areas, is slightly acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is medium to rapid. The hazard of erosion is severe if the soils are cultivated or if the pasture vegetation is thin. The Kalmia soil is occasionally flooded in some areas, and this flooding generally precludes the growing of high-value crops.

These soils are moderately well suited to the commonly grown field crops, hay, and pasture plants. They are suited to row crops only if the cropping system used helps to control erosion. The soils are moderately well suited to sprinkler irrigation if erosion is controlled.

CAPABILITY UNIT IIIe–2

This unit consists of deep, moderately well drained, sloping soils of the Angie, Bourne, and Duplin series. These soils are moderately eroded, except for the Bourne soils, which are only slightly eroded. They are on stream terraces or on uplands that generally are above the flood level.

The soils in this unit have an erodible plow layer and a subsoil that is dominantly clayey. Permeability is slow to very slow. Available water capacity is medium, and the rooting zone is deep in all but the Bourne soils, which have a moderately deep root zone. Reaction, except in limed areas, is strongly acid to very strongly acid in the root zone. The seasonal high water table is at a depth of 1½ to 3½ feet. Depth to bedrock is commonly more than 5 feet. Depth to the fragipan in Bourne soils is 18 to 30 inches. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is medium. The hazard of erosion is severe if the soils are cultivated or if the pasture vegetation is thin. In some areas the Angie soil receives seepage and runoff from higher lying areas.

The soils in this unit are moderately well suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived on these soils because of seasonal wetness. These soils are suited to row crops only if the cropping system used helps to control erosion. The soils are moderately well suited to sprinkler irrigation if erosion is controlled.

CAPABILITY UNIT IIIe–3

This unit consists of deep, moderately well drained, gently sloping soils of the Creedmoor and Helena series. The soils are moderately eroded. These soils are on uplands underlain by Coastal Plain sediment or by granite, gneiss, and schist.

The soils in this unit have a friable and erodible plow layer. They have a lower annual tolerable soil loss than most other upland soils in the county. Creedmoor and Helena soils have a dominantly very firm, sticky and plastic, clay subsoil. Permeability is slow to very slow in all the soils. Available water capacity is medium, and the rooting zone is moderately deep. Reaction, except in limed areas, is very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is low to medium.

Runoff on these soils is medium. The hazard of erosion is severe if the soils are cultivated or if the pasture vegetation is thin.

These soils are moderately well suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived on these soils because of seasonal wetness. Planting is occasionally delayed because the soils dry out slowly. These soils are moderately well suited to row crops only if the cropping system used helps to control erosion. The soils are moderately well suited to sprinkler irrigation if erosion is controlled.

CAPABILITY UNIT IIIw–1

This unit consists of deep, somewhat poorly drained, nearly level soils of the Bertie, Lenoir, Lynchburg, and Orange series. These soils are not eroded or are only slightly eroded. They are either on low stream terraces or in low-lying upland areas. Most of these soils are occasionally to frequently flooded.

The soils in this unit have a friable plow layer. Orange soils have a very firm, sticky and plastic, clay subsoil. Lenoir soils have a dominantly clayey subsoil. The other soils have a dominantly sandy clay loam or clay loam subsoil. Permeability in these soils is moderate to slow. Available water capacity is medium to high, and the rooting zone is deep. Reaction, except in limed areas, is strongly acid to extremely acid in the root zone. The seasonal high water table is at a depth of 1 to 1½ feet. Depth to bedrock is commonly more than 5 feet, but Orange soils have bedrock at a depth of 3½ to 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium.

These soils commonly receive seepage and surface runoff from higher lying areas. Flooding and a seasonal high water table are the principal hazards to farming these soils. Flooding is common in spring and early in summer and often precludes the growing of high-value crops. Artificial drainage helps to alleviate seasonal wetness in these soils.

These soils are moderately well suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived because of seasonal wetness. Planting is often delayed because the soils dry out slowly. Pasture and hay plants that can withstand flooding and seasonal wetness are suited to these soils. These soils are moderately well suited to sprinkler irrigation.

CAPABILITY UNIT IIIw–2

Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes, is the only soil in this unit. It is deep, moderately well drained to somewhat poorly drained, and nearly level to gently sloping. This soil is not eroded or is only slightly eroded. It is on upland flats, along drainageways, and at the heads of drainageways.

This soil has a friable plow layer. It has a subsoil of dominantly sandy clay loam and a fragipan of fine sandy loam or sandy loam. Permeability is slow. Available water capacity is low, and the rooting zone is moderately deep. Reaction, except in limed areas, is very strongly acid in the root zone. The seasonal high water table is at a depth of 1 to 1½ feet. Depth of bedrock is more than 4 feet. The capacity of this soil to store and release plant nutrients for crop use is low.

The soil commonly receives seepage and surface runoff from higher lying areas, and they often pond after heavy rains. Artificial drainage helps to alleviate wetness in this soil. This soil is often droughty in the growing season.

This soil is moderately well suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived because of seasonal wetness. Planting is often delayed because the soils dry out slowly. Pasture and hay plants that can withstand seasonal wetness and droughty conditions are suited to these soils. This soil is moderately well suited to sprinkler irrigation.

CAPABILITY UNIT IIIw–3

This unit consists of deep, well-drained or somewhat poorly drained, nearly level soils of the Chewacla and Riverview series. These soils are on flood plains.

These soils have a friable plow layer. They lack distinct subsoil layers of clay accumulation but have underlying layers dominantly of silt loam. Permeability is moderate. Available water capacity is high, and the rooting zone is deep. Reaction, except in limed areas, is medium acid to strongly acid in the root zone. The seasonal high water table is at a depth of 1½ to 4 feet. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is high.

Flooding and a seasonal high water table are the principal hazards to farming these soils. Flooding is common in spring and early in summer and often precludes the growing of high-value crops. Local silting is a problem in some areas after flooding. Artificial drainage helps to alleviate seasonal wetness.

These soils are suited to summer crops, including truck crops, that can be planted after the normal flooding season. The hazard of erosion is little or none, and row crops can be grown year after year if improved management is used. Pasture and hay plants that can withstand flooding and seasonal wetness are well suited to these soils. These soils are suited to sprinkler irrigation.

CAPABILITY UNIT IIIs–1

This unit consists of deep, somewhat excessively drained to moderately well drained, nearly level to

sloping soils of the Buncombe, Pactolus, and Rumford series. These soils are not eroded or are only slightly eroded. They are on uplands or on terraces and flood plains. They are occasionally flooded, except for Rumford soils, which are generally above flood level.

These soils have a thick, friable plow layer. Rumford soils have a subsoil of dominantly sandy loam. The other soils lack distinct subsoil layers of clay accumulation but have underlying layers dominantly of loamy fine sand. Permeability is moderately rapid to rapid in all of these soils. Available water capacity is low, and the rooting zone is deep. Reaction, except in limed areas, is medium acid to very strongly acid in the root zone. Pactolus soils have a seasonal high water table at a depth of 1½ to 2½ feet. Depth to bedrock is commonly more than 5 feet. The capacity of all of these soils to store and release plant nutrients for crop use is low.

These soils are droughty in the growing season because of the low available water capacity. Crop response to lime and fertilizer is limited by a low capacity to store and release plant nutrients and by a low available water capacity. Flooding is also a hazard to farming on Buncombe and Pactolus soils.

These soils are only moderately well suited to the commonly grown field crops, hay, and pasture plants. Pasture and hay plants that can withstand droughty conditions and flooding on the Buncombe and Pactolus soils are more suited to those soils. These soils are moderately well suited to sprinkler irrigation.

CAPABILITY UNIT IVe–1

This unit consists of deep, well-drained, sloping to moderately steep soils of the Appling, Caroline, Cecil, and Kempsville series. These soils are moderately eroded. They are on uplands underlain by granite and gneiss or by Coastal Plain sediments.

These soils have a friable plow layer. All of the soils have a dominantly clayey subsoil, except for Kempsville soils, which have a dominantly sandy clay loam subsoil. Permeability is moderate to moderately slow. Available water capacity is medium, and the rooting zone is deep. Reaction, except in limed areas, is strongly acid to very strongly acid in the root zone. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is rapid. The hazard of erosion is very severe if the soils are cultivated or if the pasture vegetation is thin. Erosion is more difficult to control on steeper soils.

These soils are poorly suited to the commonly grown field crops, hay, and pasture plants. They are suited to row crops only if the cropping system used helps to control erosion. They are not suited to sprinkler irrigation.

CAPABILITY UNIT IVe–2

This unit consists of deep, well drained to moderately well drained, gently sloping to moderately steep soils of the Appling, Caroline, Cecil, Duplin, Pamunkey, and Turbeville series. All of these soils are severely eroded. They are on uplands or on stream terraces that generally are above flood level.

Because they are severely eroded, the soils in this unit have a plow layer that is difficult to work and to keep in good tilth. This layer is dominantly sticky clay loam that forms a crust after hard rains, and it is low in content of organic matter. These soils have a dominantly clayey subsoil, except for the Pamunkey soils, which have a dominantly sandy clay loam subsoil. Permeability is moderate to slow. Available water capacity is medium, and the rooting zone is deep. Reaction, except in limed areas, is slightly acid to very strongly acid in the root zone. The Duplin soil has a seasonal high water table at a depth of 1½ to 2½ feet. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is medium.

Runoff on these soils is medium to rapid. The hazard of erosion is very severe if the soils are cultivated or if the pasture vegetation is thin. The potential for crop growth is considerably less than it is for less eroded soils of the same series and slope range.

The soils in this unit are poorly suited to the commonly grown field crops, hay, and pasture plants. A high level of management is commonly needed to assure good stands of alfalfa and other grasses and legumes. These soils are suited to row crops only if the cropping system used helps to control erosion. The tolerable soil loss in tons per acre per year is lower on these soils than on less eroded soils of the same series. Because of the unfavorable physical condition of the plow layer, these soils are not suitable for sprinkler irrigation.

CAPABILITY UNIT IVe–3

This unit consists of deep, moderately well drained, sloping to moderately steep soils of the Angie, Creedmoor, Duplin, and Helena series. These soils are moderately eroded. They are either on uplands or on stream terraces that generally are above flood level.

These soils have a friable and erodible plow layer. Angie and Duplin soils have a dominantly clayey subsoil. Creedmoor and Helena soils have a dominantly very firm, sticky and plastic, clay subsoil. Permeability in all of these soils is slow to very slow. Available water capacity is medium, and the rooting zone is moderately deep. Reaction, except in limed areas, is very strongly acid in the root zone. The seasonal high water table is at a depth of 1½ to 3½ feet. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release plant nutrients for crop use is low to medium.

Runoff on these soils is medium to rapid. The hazard of erosion is very severe if they are cultivated or if the pasture vegetation is thin.

These soils are poorly suited to the commonly grown field crops, hay, and pasture plants. Alfalfa is short lived on these soils because of seasonal wetness. Planting is occasionally delayed because the soils dry out slowly. These soils are not suited to sprinkler irrigation.

CAPABILITY UNIT IVe–4

Ashlar gravelly sandy loam, 6 to 15 percent slopes, is the only soil in this unit. This is a moderately deep, somewhat excessively drained to excessively drained,

sloping soil. It is slightly eroded and is on uplands underlain by granite and gneiss.

This soil has a friable and erodible plow layer. It does not have distinct subsoil layers of clay accumulation but has underlying layers dominantly of sandy loam. Permeability is moderately rapid. Available water capacity is low, and the rooting zone is moderately deep. Reaction, except in limed areas, is strongly acid to very strongly acid in the root zone. Depth to bedrock is from 2 to 3½ feet. The capacity of this soil to store and release plant nutrients for crop use is low.

Runoff on this soil is medium to rapid. The hazard of erosion is severe if the soil is cultivated or if the pasture vegetation is thin. The soil is droughty in the growing season.

This soil is poorly suited to the commonly grown field crops, hay, and pasture plants. Crop response to lime and fertilizer is limited by a low available water capacity, a moderately deep rooting zone, and a low capacity to store and release plant nutrients for crop use. This soil is better suited to close-growing crops than to row crops and to drought-resistant pasture and hay plants.

CAPABILITY UNIT IVw–1

This unit consists of moderately deep to deep, somewhat poorly drained to very poorly drained, nearly level soils of the Chastain, Coxville, Forestdale, Kinston, Mantachie, Myatt, Portsmouth, Pouncey, Rains, and Roanoke series. These soils are on flood plains, low terraces, and upland flats that are occasionally to very frequently flooded.

These soils have a friable plow layer. Kinston, Mantachie, Myatt, and Portsmouth soils have a dominantly sandy clay loam, clay loam, or silty clay loam subsoil. The other soils have a dominantly clayey subsoil. Permeability in these soils is moderate to very slow. Available water capacity is low to high, and the rooting zone is moderately deep to deep. Reaction, except in limed areas, is medium acid to extremely acid in the root zone. The seasonal high water table is at the surface or to a depth of 1 foot. Depth to bedrock ranges from 1½ feet in some areas of Pouncey soils to more than 5 feet in most of the others. The capacity of these soils to store and release plant nutrients for crop use is low to medium.

Flooding and seasonal wetness are the principal hazards to farming these soils. All of these soils receive seepage and runoff from higher lying areas. Artificial drainage helps to alleviate seasonal wetness.

These soils are poorly suited to the commonly grown field crops, hay, and pasture plants. They are better suited to water-tolerant crops, hay, and pasture plants.

CAPABILITY UNIT VIe–1

This unit consists of moderately deep, somewhat excessively drained to excessively drained, sloping to steep soils of the Ashlar and Pinkston series and deep, moderately well drained to excessively drained, sloping to strongly sloping Ochrepts and Udults. These soils are commonly slightly eroded and are on uplands.

The surface layer of these soils ranges from loamy fine sand and loamy sand to clay. The subsoil ranges from sand and fine sand to clay. Permeability in these soils is moderately rapid to moderately slow. Available water capacity is low to medium, and the rooting zone is moderately deep to deep. Reaction, except in limed areas, is strongly acid to extremely acid in the root zone. Depth to bedrock ranges from 2 feet to more than 5 feet. The capacity of these soils to store and release nutrients for plant use is low to medium.

Runoff on these soils is rapid. The hazard of erosion is severe the soil is exposed or if the vegetation is thin. There is an increasing difficulty in controlling erosion as the slope increases within the slope limits of the mapping units. These soils are droughty in the growing season.

These soils are suited to drought-resistant hay and pasture plants and to woodland.

CAPABILITY UNIT VIw–1

Aquents, loamy, is the only soil in this unit. This consists of soil materials dredged from stream channels, usually several feet or more thick. It is poorly drained, nearly level, and frequently flooded.

This soil material is commonly silt loam or loam. Permeability is slow in this soil, and the available water capacity is medium to high. Reaction is medium acid to strongly acid.

Runoff on this soil material is slow. Flooding and seasonal wetness severely restrict the use of this soil material.

CAPABILITY UNIT VIIe–1

This unit consists of deep, moderately well drained to excessively drained, moderately steep to steep Ochrepts and Udults and gently sloping to moderately steep Orthents-Udults-Mine pits complex. These soils are on uplands.

These soils have a surface layer that ranges from loamy fine sand and loamy sand to clay. The subsoil ranges from sand and fine sand to clay. Permeability in these soils is moderately rapid to slow. Available water capacity is low to medium. Reaction is medium acid to extremely acid. Depth to bedrock is commonly more than 5 feet. The capacity of these soils to store and release nutrients for plant use is low to medium.

Runoff on these soils is slow to rapid. The hazard of erosion is severe if exposed or if the vegetation is thin. The difficulty of controlling erosion increases as the slope increases within the slope limits of the mapping units. Ochrepts and Udults are droughty in the growing season.

These soils are suited to pasture and to woodland (fig. 7).

CAPABILITY UNIT VIIw–1

This unit consists of Fluvaquents and Hydraquents. They include low, wet alluvium along the streams of the county. Their surfaces are covered by either fresh water or tidal water most of the time.

Fluvaquents and Hydraquents are so wet and their reclamation so impractical and expensive that their use for farming is improbable. Some timber or other woodland products may be obtained from Fluvaquents,

Figure 7.—**Ochrepts and Udults in permanent pasture.**

but their use is commonly limited to woodland and wildlife habitat. Hydraquents are commonly limited to wildlife habitat.

Estimated yields

The soils of Henrico County vary a great deal in their suitability for crops. Some of them consistently produce fairly high yields of most cultivated crops. Others, although suitable for crops, produce lower yields. Some soils are suited to less intensive use.

Table 2 gives estimates of the average acre yields of the principal crops that can be obtained on the soils of Henrico County under an improved level of management. The management includes the use of lime and fertilizer in amounts currently recommended by the Virginia Agricultural Experiment Station. It also includes control of erosion; drainage where needed; proper preparation of the seedbed; use of a suitable cropping system and of crop residue; control of plant diseases, weeds, and insects; and, for pasture, regulation of grazing. Figures in table 2 are based on observations made by the soil survey party and on yields reported by some farmers and other agricultural workers in the county and in nearby counties in Virginia. These yields are not presumed to be the highest yields obtainable, but instead set a practical goal for most farmers if they use improved management. Yields from the same soil can be expected to vary because of differences in management, weather, crop varieties, and in the number and kinds of insects and diseases.

Woodland Uses of the Soils [2]

Approximately 89,000 acres, or about 60 percent of the land area of Henrico County, is wooded. Most of this is in second growth hardwoods, loblolly pine, and Virginia pine.

The original tree growth consisted of mixed stands of Chestnut oak, white oak, post oak, scarlet oak, black oak, northern red oak, southern red oak, and hickory. Yellow-popular was on the more moist sites. Shortleaf pine and Virginia pine were scattered throughout these hardwood stands. Poorly drained areas were covered by mixed stands of green ash, sweetgum, blackgum, boxelder, and red maple.

Most of the original woodland was cleared and the soils were cultivated as the lands were settled and consolidated into farm holdings. Gradually, as the soils became eroded and fertility became depleted, the soils were allowed to return to woodland. The present stands of mixed hardwoods, Virginia pine, and loblolly pine are mostly the results of the abandoning of farmland.

[2] By LUITPOLD W. KEMPF, woodland conservationist, Soil Conservation Service.

TABLE 2.—*Estimated average acre yields of principal crops under improved management*

[Absence of data indicates stated crop is not grown, or the soil is not suited to it. Aquents, loamy (AQ), Fluvaquents (FL), Hydraquents (HS), Ochrepts and Udults (OUD, OUF), Orthents-Udults-Mine pits complex (OW), Psamments, gently sloping (PTB), Udorthents (UD, UE), and Urban land (UR) are not included in this table because their properties are too variable to estimate]

Mapping unit	Corn	Corn silage	Wheat	Barley	Soybeans	Alfalfa	Grass-legume	Pasture
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cow-acre-days* [1]
Abell fine sandy loam, 2 to 6 percent slopes	120	24	[2] 60	[2] 60	40	[3] 3.5	4.0	280
Altavista fine sandy loam, 0 to 2 percent slopes	120	24	[2] 60	[2] 50	40	[3] 3.5	4.0	280
Altavista fine sandy loam, 2 to 6 percent slopes	120	24	65	50	40	[3] 4.0	4.0	280
Angie loam, 0 to 2 percent slopes	110	22	[2] 60	[2] 45	40	[3] 3.5	4.0	250
Angie loam, 2 to 6 percent slopes	110	22	60	45	40	[3] 3.5	3.5	250
Angie loam, 2 to 6 percent slopes, eroded	100	20	55	40	35	[3] 3.0	3.0	240
Angie loam, 6 to 10 percent slopes, eroded	90	18	50	40	30	[3] 3.0	2.5	210
Angie loam, 10 to 25 percent slopes, eroded	55	11	35				2.0	120
Angie loam, concretionary subsoil variant	95	19	[2] 50	[2] 45	35		3.5	240
Appling fine sandy loam, 2 to 6 percent slopes	120	24	75	60	40	4.5	4.0	270
Appling fine sandy loam, 6 to 15 percent slopes, eroded	95	19	50	45	30	3.5	3.0	220
Appling fine sandy loam, 15 to 25 percent slopes, eroded	75	15	40	35		2.5	2.0	180
Appling clay loam, 2 to 15 percent slopes, severely eroded	75	15	35	30		2.5	2.0	140
Ashlar gravelly sandy loam, 6 to 15 percent slopes	45	9	35				1.0	90
Ashlar gravelly sandy loam, 15 to 45 percent slopes								90
Atlee very fine sandy loam	90	18	50	40	30	[3] 3.0	3.5	225
Bertie fine sandy loam	80	16		40	30		3.0	190
Bourne fine sandy loam, 0 to 2 percent slopes	80	16	40	35	25		2.5	160
Bourne fine sandy loam, 2 to 6 percent slopes	70	14	40	30	25		2.0	150
Bourne fine sandy loam, 6 to 10 percent slopes	50	10	35				1.5	110
Buncombe loamy fine sand	60	12	30	30	20	2.5	1.5	120
Caroline very fine sandy loam, 2 to 6 percent slopes, eroded	110	22	65	50	35	3.8	3.0	225
Caroline very fine sandy loam, 6 to 10 percent slopes, eroded	90	18	50	45	30	3.5	2.8	200
Caroline very fine sandy loam, 10 to 15 percent slopes, eroded	70	14	40	35	30		2.5	180
Caroline clay loam, 2 to 10 percent slopes, severely eroded	65	13	35	30	20	2.0	2.0	120
Cecil fine sandy loam, 2 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.0	240
Cecil fine sandy loam, 10 to 25 percent slopes, eroded	80	16	45	40		3.0	2.5	180
Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded	70	14	35	30		2.5	2.0	140
Chastain silt loam	70	14						210
Chewacla silt loam	90	18					2.5	225
Chewacla silt loam, clayey substratum	90	18					2.5	225
Chewacla and Riverview soils	90	18					2.8	240
Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes	60	12					2.5	150
Coxville silt loam	50	10						180
Creedmoor sandy loam, 2 to 6 percent slopes	95	19	50	40	30	2.5	2.5	190
Creedmoor sandy loam, 2 to 6 percent slopes, eroded	80	16	45	35	25		2.0	170
Creedmoor sandy loam, 6 to 10 percent slopes, eroded	50	10	35				2.0	120
Duplin very fine sandy loam, 2 to 6 percent slopes, eroded	110	22	60	45	35	[3] 3.0	3.5	240
Duplin very fine sandy loam, 6 to 10 percent slopes, eroded	95	19	55	50	30	[3] 3.0	3.0	210
Duplin very fine sandy loam, 10 to 15 percent slopes, eroded	55	11	35				2.0	120
Duplin silt loam, 0 to 2 percent slopes	120	24	60	45	40	[3] 3.0	3.5	260
Duplin clay loam, 2 to 10 percent slopes, severely eroded	65	13	35	30	20		2.0	130
Faceville fine sandy loam, 0 to 2 percent slopes	130	26	75	65	45	4.5	4.0	280
Faceville fine sandy loam, 2 to 6 percent slopes, eroded	110	22	65	55	40	4.0	3.5	250
Forestdale silt loam	65	13						210

TABLE 2.—*Estimated average acre yields of principal crops under improved management*—Continued

Mapping unit	Corn	Corn silage	Wheat	Barley	Soybeans	Alfalfa	Grass-legume	Pasture
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cow-acre-days* [1]
Helena fine sandy loam, 2 to 6 percent slopes	95	19	50	40	30	[3] 2.5	2.5	190
Helena fine sandy loam, 2 to 6 percent slopes, eroded	80	16	45	35	25		2.0	170
Helena fine sandy loam, 6 to 15 percent slopes, eroded	50	10	35				2.0	110
Kalmia fine sandy loam, 0 to 2 percent slopes	130	26	75	60	40	4.0	3.8	265
Kalmia fine sandy loam, 2 to 10 percent slopes	100	20	60	50	35	3.5	3.5	240
Kempsville fine sandy loam, 0 to 2 percent slopes	130	26	75	60	40	4.0	3.8	265
Kempsville fine sandy loam, 2 to 6 percent slopes	120	24	75	55	35	3.8	3.0	240
Kempsville fine sandy loam, 2 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.0	220
Kempsville fine sandy loam, 10 to 25 percent slopes, eroded	80	16	45	40		3.0	2.5	180
Kempsville fine sandy loam, flooded, 0 to 2 percent slopes	110	22	[2] 50	[2] 55	40	[3] 3.5	3.5	260
Kempsville fine sandy loam, flooded, 2 to 6 percent slopes	110	22	[2] 50	[2] 55	40	[3] 3.5	3.5	250
Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes	130	26	75	65	40	4.2	4.0	275
Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes	120	24	75	60	40	4.0	3.5	260
Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.0	240
Kinston silt loam	60	12						200
Kinston and Mantachie soils	50	10						180
Lenoir silt loam	90	18		40	30		3.0	190
Lynchburg fine sandy loam	80	16		35	25		2.5	160
Mantachie-Chastain complex	50	10						190
Mayodan fine sandy loam, 2 to 6 percent slopes, eroded	105	21	60	45	30	3.5	3.0	210
Myatt fine sandy loam	70	14						190
Norfolk fine sandy loam, 0 to 2 percent slopes	130	26	70	60	40	4.0	3.5	270
Norfolk fine sandy loam, 2 to 6 percent slopes	125	25	70	60	40	4.0	3.5	270
Norfolk fine sandy loam, 6 to 10 percent slopes	100	20	60	50	40	3.5	3.0	240
Orange loam	70	14		30	25		2.5	160
Pactolus loamy fine sand	70	14	40	30	20	[3] 2.5	1.5	120
Pamunkey fine sandy loam, 0 to 2 percent slopes	130	26	75	65	45	4.5	4.0	280
Pamunkey fine sandy loam, 2 to 6 percent slopes	125	25	75	60	40	4.5	4.0	270
Pamunkey fine sandy loam, 6 to 15 percent slopes	100	20	60	50	35	3.5	3.5	240
Pamunkey clay loam, 6 to 15 percent slopes, severely eroded	70	14	35	30	25	2.5	2.0	140
Pinkston fine sandy loam, 6 to 25 percent slopes								120
Portsmouth silt loam	70	14						190
Pouncey sandy loam	50	10						180
Rains very fine sandy loam	60	12						190
Riverview silt loam	120	24	[2] 60	[2] 60	40	[3] 4.0	4.0	280
Roanoke silt loam	65	13						200
Rumford loamy sand, 0 to 10 percent slopes	75	15	40	35	25	3.0	2.0	150
Ruston fine sandy loam, 0 to 2 percent slopes	130	26	75	65	45	4.5	4.0	280
Ruston fine sandy loam, 2 to 6 percent slopes	120	24	65	55	40	4.0	3.5	260
Ruston fine sandy loam, 6 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.0	240
Sassafras fine sandy loam, 0 to 2 percent slopes	120	24	70	60	40	3.8	3.2	260
Sassafras fine sandy loam, 2 to 6 percent slopes	120	24	65	55	40	4.0	3.5	260
State fine sandy loam, clayey substratum, 0 to 2 percent slopes	130	26	70	60	40	4.5	4.0	280
State fine sandy loam, clayey substratum, 2 to 6 percent slopes	125	25	70	60	40	4.5	4.0	270
State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.5	240
State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes	105	21	60	45	30	3.5	3.0	210
Tetotum fine sandy loam	110	22	[2] 60	[2] 50	40	[3] 3.5	3.5	260

TABLE 2.—*Estimated average acre yields of principal crops under improved management*—Continued

Mapping unit	Corn	Corn silage	Wheat	Barley	Soybeans	Alfalfa	Grass-legume	Pasture
	Bu	*Tons*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Cow-acre-days* [1]
Tetotum loam, flooded	100	20	[2] 50	[2] 50	35	[3] 3.5	3.0	250
Toccoa fine sandy loam	100	20	[2] 50	[2] 50	35	[3] 3.5	3.5	240
Turbeville fine sandy loam, 0 to 2 percent slopes	130	26	75	65	45	4.5	4.0	280
Turbeville fine sandy loam, 2 to 6 percent slopes	125	25	75	60	40	4.5	4.0	270
Turbeville fine sandy loam, 6 to 10 percent slopes, eroded	100	20	60	50	35	3.5	3.5	240
Turbeville gravelly fine sandy loam, 2 to 6 percent slopes	105	21	60	45	30	3.5	3.0	210
Turbeville gravelly fine sandy loam, 6 to 10 percent slopes	80	16	45	40	30	3.0	2.5	180
Wedowee sandy loam, 2 to 6 percent slopes	105	25	60	45	30	3.5	3.0	210
Wedowee sandy loam, 6 to 15 percent slopes	90	18	50	40	30	3.0	2.5	180

[1] A term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single season without injury to the sod. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

[2] Small grains lodge on this soil.

[3] Alfalfa is short lived on this soil.

Woodland suitability groups

The soils of Henrico County have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group consists of soils that are suited to the same kinds of trees, that require similar management, and that have similar potential productivity.

Each woodland group is identified by a three-part symbol, such as 1o1, 2w1, or 4c1. The first part of the symbol, always an Arabic number, identifies relative potential productivity of the soils in the group for an indicator tree species or forest type, usually the most important adopted tree species or type, according to the following ratings: 1 = very high; 2 = high; 3 = moderately high; 4 = moderate; and 5 = low. These ratings are based on field determinations of average site index. Site index is the height, in feet, that the taller trees of a given species, on a specified kind of soil, reach in a natural, essentially unmanaged stand in 50 years.

The second part of the symbol in identifying a woodland group is a lower case letter. This letter indicates an important soil property associated with a moderate hazard or limitation or a severe hazard or limitation in managing the soils of the group for woodcrops. A letter *w*, for example, indicates that water in or on the soils, either seasonally or year round, is the chief limitation; *d* indicates that rooting depth is restricted because the soils are shallow to a hardpan, to hard rock, or to some other restrictive material; *c* indicates that the main limitation is the kind or amount of clay in the upper part of the soils in the group; *s* indicates that the soils are sandy and dry, have little or no difference in texture between the surface layer and the subsoil (or B horizon), have a low available water capacity, and generally have a low supply of plant nutrients; *r* indicates that the main limitation is steep slopes; and *o* indicates that the soils have few limitations that restrict their use for trees. Some soils may have more than one kind of limitation. Priority in placing a soil in a subclass is determined by the order in which the subclass characteristics are listed above.

The last part of the symbol, another Arabic number, merely differentiates one woodland suitability group, on the basis of different management needs, from others that have identical first and second parts in their identifying symbol. For example, the last (Arabic) number in the symbol 2w1 differentiates the woodland suitability group bearing that last number from all other groups having 2w as the first two parts of their identifying symbol.

In table 3 each woodland suitability group in Henrico County is listed. Important parts of this table are the limitation ratings for: (1) the hazard of erosion, (2) the use of equipment, (3) the hazard of seedling mortality, (4) the risk of competition from undesirable plants, and (5) the hazard of windthrow. These ratings are always *slight*, *moderate*, or *severe*. The following explanations of these ratings apply to the descriptions of all the woodland suitability groups in Henrico County.

Erosion hazard refers to the potential hazard of soil loss in well-managed woodland. The hazard is *slight* if expected soil loss is small; *moderate* if some soil loss is expected and care is needed during logging and construction to reduce the risk of erosion; *severe* if special methods of operation are necessary to prevent excessive soil loss. In Henrico County only the steep soils are subject to severe erosion.

Equipment limitations are rated on the basis of soil characteristics that restrict or prohibit the use of equipment commonly used in tending and harvesting the trees. In Henrico County such unfavorable soil characteristics are wetness, depth to the water table, slope, and texture of the surface layer. The limitation is *slight* if there is no restriction on the kind of equipment or on the time of year that the equipment can be

TABLE 3.—*Potential productivity, suitable trees,*

[Aquents, loamy (AQ), Fluvaquents (FL), Hydraquents (HS), Orthents-Udults-Mine pits complex (OW), Psamments, gently sloping

Woodland suitability group and mapping unit symbols	Potential productivity		Suitable species—	
	Species	Site index	To favor in existing stands	For planting
Group 1w1: Deep, somewhat poorly drained soils that have high available water capacity; on flood plains; slopes range from 0 to 2 percent. Ch, Ck, Cm.	Northern red oak White oak Loblolly pine Yellow-poplar	85+ 85+ 95+ 95+	Northern red oak, white oak, loblolly pine, red maple.	Loblolly pine
Group 1w2: Deep, poorly drained soils that have medium available water capacity; on low terraces; slopes range from 0 to 2 percent. Fo, Ro.	Loblolly pine Willow oak Virginia pine	95+ 85+ 65–75	Loblolly pine, willow oak, Virginia pine, green ash.	Loblolly pine
Group 1o1: Deep, well-drained soils that have medium to high available water capacity; on flood plains; slopes range from 0 to 2 percent. Re, To.	Loblolly pine Northern red oak White oak Yellow-poplar Virginia pine	85–95 75–85 75–85 85–95 75–85	Loblolly pine, northern red oak, white oak, yellow-poplar, Virginia pine, black walnut.	Loblolly pine, black walnut.
Group 2w1: Deep, somewhat poorly drained soil that has low available water capacity; on upland flats, along drainageways and around the heads of drainageways; slopes range from 0 to 6 percent. CoB.	Loblolly pine Northern red oak White oak	80–90 75–85 75–85	Loblolly pine, northern red oak, white oak, sweetgum, red maple.	Loblolly pine
Group 2w2: Deep, somewhat poorly drained soil that has high available water capacity; on upland flats and in small depressions; slopes range from 0 to 2 percent. Ly.	Loblolly pine Northern red oak White oak	85–95 70–80 70–80	Loblolly pine, northern red oak, white oak, sweetgum.	Loblolly pine
Group 2w3: Moderately deep to deep, poorly drained to very poorly drained soils that have low to high available water capacity; on flood plains, low terraces, and upland flats; slopes range from 0 to 2 percent. Km, Kn, My, Pr, Ps, Ra.	Loblolly pine Willow oak Sweetgum	85–95 70–80 70–80	Loblolly pine, willow oak, sweetgum.	Loblolly pine
Group 2s1: Deep, moderately well drained to excessively drained soils that have low available water capacity; on flood plains and low terraces; slopes range from 0 to 2 percent. Bu, Pa.	Loblolly pine Northern red oak White oak Yellow-poplar	85–95 75–85 75–85 85–95	Loblolly pine, northern red oak, white oak, yellow-poplar.	Loblolly pine
Group 2r1: Deep, moderately well drained to excessively drained soil that has low to medium water capacity; on uplands; slopes range from 15 to 50 percent. OUF.	Northern red oak White oak Loblolly pine Virginia pine	75–85 75–85 85–95 75–85	Northern red oak, white oak, yellow-poplar, loblolly pine, Virginia pine.	Loblolly pine
Group 2o1: Deep, moderately well drained to well drained soils that have medium to high available water capacity; on foot slopes, at heads of drainageways, on terraces, and on uplands; slopes range from 0 to 15 percent. AbB, AfA, AfB, KaA, KaC, OUD, PmA, PmB, PmD, PnC3, RuA, RuB, RuC2.	Northern red oak White oak Yellow-poplar Loblolly pine Virginia pine	75–85 75–85 85–95 85–95 75–85	Northern red oak, white oak, yellow-poplar, shortleaf pine, Virginia pine, black walnut.	Loblolly pine, yellow-poplar, black walnut.
Group 3w1: Deep, somewhat poorly drained soils that have medium available water capacity; on low terraces and in low-lying areas; slopes range from 0 to 2 percent. Be, Le.	Loblolly pine Northern red oak White oak Sweetgum	75–85 65–75 65–75 75–85	Northern red oak, white oak, loblolly pine, sweetgum.	Loblolly pine
Group 3w2: Deep, poorly drained soils that have medium available water capacity; on flood plains and upland flats; slopes range from 0 to 2 percent. Cg, Cp, Mc.	Loblolly pine Sweetgum	75–85 75–85	Loblolly pine, sweetgum.	Loblolly pine
Group 3d1: Moderately deep, somewhat excessively drained to excessively drained soils that have low available water capacity; on uplands; slopes range from 6 to 45 percent. AsD, AsE.	Northern red oak White oak Virginia pine	65–75 65–75 65–75	Virginia pine, northern red oak, white oak.	Loblolly pine

and limitations of soils when used as woodland

(PTB), Udorthents (UD, UE), and Urban land (UR) are not included in this table because their properties are too variable to estimate]

Erosion hazard	Equipment limitations	Seedling mortality	Windthrow hazard	Plant competition	
				Conifers	Hardwoods
Slight	Moderate	Slight	Slight	Severe	Severe.
Slight	Severe	Severe	Slight	Severe	Severe.
Slight	Slight	Slight	Slight	Severe	Moderate.
Slight	Moderate	Slight	Slight	Severe	Severe.
Slight	Moderate	Slight	Slight	Severe	Moderate.
Slight	Severe	Severe	Slight	Severe	Severe.
Slight	Slight to moderate	Moderate	Slight	Moderate	Slight.
Moderate	Moderate	Slight	Slight	Severe	Moderate.
Slight	Slight	Slight	Slight	Severe	Moderate.
Slight	Moderate	Slight	Slight	Severe	Moderate.
Slight	Severe	Severe	Moderate	Severe	Severe.
Moderate	Moderate	Severe	Moderate	Moderate	Slight.

TABLE 3.—*Potential productivity, suitable trees, and*

Woodland suitability group and mapping unit symbols	Potential productivity		Suitable species—	
	Species	Site index	To favor in existing stands	For planting
Group 3r1: Deep, well drained and moderately well drained soils that have medium available water capacity; on uplands and terraces; slopes range from 10 to 25 percent. AgE2, AmE2, CeD2.	Loblolly pine Northern red oak White oak Virginia pine	75–85 65–75 65–75 65–75	Loblolly pine, Virginia pine, northern red oak, white oak, yellow-poplar.	Loblolly pine
Group 3r2: Deep, well drained soil that has medium available water capacity; on uplands; slopes range from 10 to 25 percent. KeD2.	Loblolly pine Northern red oak White oak Virginia pine	70–80 65–70 65–70 65–70	Loblolly pine, northern red oak, white oak, Virginia pine.	Loblolly pine
Group 3o1: Deep, moderately well drained, well drained, and somewhat excessively drained soils that have medium to high available water capacity; on terraces and uplands; slopes range from 0 to 15 percent. AgA, AgB, AgB2, AgC2, Ak, AmB, AmC2, At, CaB2, CaC2, CaD2, CeC2, DuB2, DuC2, DuD2, DvA, FaA, FaB2, KeA, KeB, KeC2, KfA, KfB, KgA, KgB, KgC2, MdB2, NoA, NoB, NoC, RrC, SsA, SsB, StA, StB, StC2, SvB, Td, Te, TuA, TuB, TuC2, TvB, TvC, WeB, WeD.	Loblolly pine Northern red oak White oak	70–80 65–75 65–75	Loblolly pine, sweetgum, northern red oak.	Loblolly pine
Group 4w1: Deep, somewhat poorly drained soil that has medium available water capacity; on upland flats; slopes range from 0 to 2 percent. Ov.	Northern red oak White oak Loblolly pine Virginia pine	55–65 55–65 65–75 55–65	Loblolly pine, Virginia pine.	Loblolly pine, Virginia pine.
Group 4d1: Deep, moderately well drained soils that have low available water capacity; on uplands; slopes range from 0 to 10 percent. BoA, BoB, BoC.	Loblolly pine Virginia pine Northern red oak White oak	65–75 55–65 55–65 55–65	Loblolly pine, Virginia pine.	Loblolly pine
Group 4d2: Moderately deep, somewhat excessively drained to excessively drained soil that has low available water capacity; on uplands; slopes range from 6 to 25 percent. PoE.	Northern red oak White oak Virginia pine Loblolly pine	55–65 55–65 55–65 65–75	Loblolly pine, Virginia pine.	Loblolly pine
Group 4c1: Deep, well drained to moderately well drained soils that have medium available water capacity; on uplands; slopes range from 2 to 25 percent. AoC3, CbC3, CfD3, CvB, CvB2, CvC2, DwC3, HeB, HeB2, HeC2.	Loblolly pine Northern red oak White oak	65–75 55–65 55–65	Loblolly pine, Virginia pine.	Loblolly pine

used. It is *moderate* if the use of equipment is restricted for less than 3 months of the year, and it is *severe* if special equipment is needed and its use is restricted for more than 3 months of the year.

Seedling mortality refers to the expected loss of seedlings as a result of unfavorable characteristics of the soil. Considered in the ratings are depth to the water table, hazard of flooding, wetness, soil depth and structure, and degree of erosion. Normal rainfall, good planting stock, and proper planting are assumed. A mortality rating of *slight* indicates that an expected loss of planted seedlings is less than 25 percent. A rating of *moderate* means that a loss of 25 to 50 percent of the seedlings planted is to be expected, and a rating of *severe* means that a loss of more than 50 percent of the seedlings planted is to be expected. Special preparation of the site is needed before planting for soils rated severe and for most soils rated moderate.

Plant competition is rated on the degree to which unwanted plants invade an area if openings are made in the tree canopy. Soil properties considered in the ratings are available water capacity, natural fertility, drainage, and degree of erosion. Competition is *slight* if unwanted plants are no special problem. It is *moderate* if invading plant competition does not prevent but only delays the establishment of a normal, fully stocked stand of desirable trees. Competition is *severe* if expected plant competition prevents establishment of a desirable stand unless intensive site preparation and such practices as weeding are used to control undesirable plants.

Windthrow hazard is related to soil characteristics that affect the development of tree roots and the firmness with which the roots anchor the tree in the soil so that it resists the force of a normal wind. The hazard of windthrow is *slight* if roots hold the tree firmly against a normal wind and if individual trees

limitations of soils when used as woodland—Continued

Erosion hazard	Equipment limitations	Seedling mortality	Windthrow hazard	Plant competition	
				Conifers	Hardwoods
Moderate	Moderate	Slight	Slight	Moderate	Slight.
Slight	Moderate	Slight	Slight	Moderate	Slight.
Slight	Slight	Slight	Slight	Moderate	Slight.
Slight	Moderate	Moderate	Moderate	Severe	Moderate.
Slight	Moderate	Moderate	Moderate	Moderate	Slight.
Severe	Severe	Severe	Moderate	Slight	Slight.
Slight	Moderate	Moderate	Moderate	Slight	Slight.

are likely to remain standing even though protective trees on all sides are removed. The hazard is *moderate* if roots develop enough to hold the tree firmly, except when the soil is excessively wet and the velocity of the wind is very high. It is *severe* if roots do not extend deep enough to give adequate stability and if individual trees are likely to be blown over if they are not protected on all sides.

Wildlife [3]

The wildlife population of any area depends on the availability of food, cover, and water in a suitable combination. The lack of any of these requirements, an unfavorable balance between them, or an inadequate distribution of them can seriously limit or make impossible the use of a tract as a habitat for desired species of wildlife. Most wildlife habitats are created, improved, or maintained by establishing and manipulating vegetation and by providing food and water in suitable places. Information about the soils is essential in carrying out these measures. Such information is also useful in broad-scale planning for parks, nature areas, or other recreational or educational developments having wildlife management aspects. It is an important aid in planning for the acquisition of land for development of wildlife habitat or protection of wildlife.

Interpretations of the usefulness of soils for wildlife habitat are helpful in selecting sites that are adaptable to wildlife management and in determining the level of management needed to achieve satisfactory results. Interpretations may also reveal reasons that make a particular area unsuitable for a specified kind of wildlife. Table 4 rates the soils of Henrico County according to their suitability for seven elements of

[3] By R. F. DUGAN, biologist, Soil Conservation Service.

TABLE 4.—*Suitability of the soils for wildlife*

[Urban land (UR) is not included in this table

Mapping unit	Elements of wildlife habitat—			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Abell fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Altavista fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Altavista fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Angie loam, 0 to 2 percent slopes	Good	Good	Good	Good
Angie loam, 2 to 6 percent slopes	Good	Good	Good	Good
Angie loam, 2 to 6 percent slopes, eroded	Good	Good	Good	Good
Angie loam, 6 to 10 percent slopes, eroded	Fair	Good	Good	Good
Angie loam, 10 to 25 percent slopes, eroded	Poor	Fair	Good	Good
Angie loam, concretionary subsoil variant	Good	Good	Good	Good
Appling fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Appling fine sandy loam, 6 to 15 percent slopes, eroded	Fair	Good	Good	Good
Appling fine sandy loam, 15 to 25 percent slopes, eroded	Poor	Fair	Good	Good
Appling clay loam, 2 to 15 percent slopes, severely eroded.	Fair	Fair	Fair	Good
Aquents, loamy	Poor	Fair	Fair	Fair
Ashlar gravelly sandy loam, 6 to 15 percent slopes	Poor	Fair	Fair	Fair
Ashlar gravelly sandy loam, 15 to 45 percent slopes	Very poor	Poor	Fair	Poor
Atlee very fine sandy loam	Good	Good	Good	Good
Bertie fine sandy loam	Fair	Good	Good	Good
Bourne fine sandy loam, 0 to 2 percent slopes	Poor	Fair	Fair	Poor
Bourne fine sandy loam, 2 to 6 percent slopes	Poor	Fair	Fair	Poor
Bourne fine sandy loam, 6 to 10 percent slopes	Poor	Fair	Fair	Poor
Buncombe loamy fine sand	Poor	Poor	Good	Poor
Caroline very fine sandy loam, 2 to 6 percent slopes, eroded.	Good	Good	Good	Good
Caroline very fine sandy loam, 6 to 10 percent slopes, eroded.	Fair	Good	Good	Good
Caroline very fine sandy loam, 10 to 15 percent slopes, eroded.	Fair	Good	Good	Good
Caroline clay loam, 2 to 10 percent slopes, severely eroded.	Fair	Fair	Fair	Good
Cecil fine sandy loam, 2 to 10 percent slopes, eroded	Fair	Good	Good	Good
Cecil fine sandy loam, 10 to 25 percent slopes, eroded	Poor	Fair	Good	Good
Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded.	Poor	Fair	Fair	Good
Chastain silt loam	Poor	Fair	Fair	Fair
Chewacla silt loam	Fair	Fair	Fair	Good
Chewacla silt loam, clayey substratum	Fair	Fair	Fair	Good
Chewacla and Riverview soils	Fair	Fair	Fair	Good
Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes.	Poor	Fair	Fair	Fair
Coxville silt loam	Poor	Poor	Poor	Fair
Creedmoor sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Creedmoor sandy loam, 2 to 6 percent slopes, eroded	Fair	Good	Good	Good
Creedmoor sandy loam, 6 to 10 percent slopes, eroded	Fair	Good	Good	Good
Duplin very fine sandy loam, 2 to 6 percent slopes, eroded.	Good	Good	Good	Good
Duplin very fine sandy loam, 6 to 10 percent slopes, eroded.	Fair	Good	Good	Good
Duplin very fine sandy loam, 10 to 15 percent slopes, eroded.	Fair	Good	Good	Good
Duplin silt loam, 0 to 2 percent slopes	Good	Good	Good	Good
Duplin clay loam, 2 to 10 percent slopes, severely eroded	Fair	Fair	Fair	Good
Faceville fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Faceville fine sandy loam, 2 to 6 percent slopes, eroded	Good	Good	Good	Good
Fluvaquents	Very poor	Very poor	Very poor	Poor
Forestdale silt loam	Poor	Fair	Fair	Fair
Helena fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Helena fine sandy loam, 2 to 6 percent slopes, eroded	Fair	Good	Good	Good
Helena fine sandy loam, 6 to 15 percent slopes, eroded	Fair	Good	Good	Good
Hydraquents	Very poor	Very poor	Very poor	Very poor
Kalmia fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Kalmia fine sandy loam, 2 to 10 percent slopes	Fair	Good	Good	Good
Kempsville fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Kempsville fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Kempsville fine sandy loam, 2 to 10 percent slopes, eroded.	Fair	Good	Good	Good
Kempsville fine sandy loam, 10 to 25 percent slopes, eroded.	Poor	Fair	Good	Good

habitat and for kinds of wildlife

because its properties are too variable to rate]

Elements of wildlife habitat—Continued			Kinds of wildlife—		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Good	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Good	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Good	Very poor	Very poor	Fair	Fair	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Poor	Fair	Good	Good	Poor.
Good	Fair	Fair	Good	Good	Fair.
Fair	Very poor	Fair	Fair	Poor	Poor.
Fair	Very poor	Very poor	Fair	Poor	Very poor.
Fair	Very poor	Very poor	Fair	Poor	Very poor.
Poor	Very poor	Very poor	Fair	Poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Fair	Good	Fair.
Fair	Very poor	Poor	Fair	Fair	Very poor.
Fair	Good	Good	Poor	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Very poor	Good	Good	Very poor	Very poor	Good.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Very poor	Good	Good	Very poor	Very poor	Good.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.

TABLE 4.—*Suitability of the soils for wildlife*

Mapping unit	Elements of wildlife habitat—			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Kempsville fine sandy loam, flooded, 0 to 2 percent slopes.	Good	Good	Good	Good
Kempsville fine sandy loam, flooded, 2 to 6 percent slopes.	Good	Good	Good	Good
Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes.	Good	Good	Good	Good
Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes.	Good	Good	Good	Good
Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded.	Fair	Good	Good	Good
Kinston silt loam	Poor	Fair	Fair	Fair
Kinston and Mantachie soils	Poor	Fair	Fair	Fair
Lenoir silt loam	Fair	Good	Good	Good
Lynchburg fine sandy loam	Fair	Good	Good	Good
Mantachie-Chastain complex	Poor	Fair	Fair	Fair
Mayodan fine sandy loam, 2 to 6 percent slopes, eroded	Good	Good	Good	Good
Myatt fine sandy loam	Poor	Fair	Fair	Fair
Norfolk fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Norfolk fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Norfolk fine sandy loam, 6 to 10 percent slopes	Fair	Good	Good	Good
Ochrepts and Udults, sloping	Fair	Good	Good	Good
Ochrepts and Udults, steep	Poor	Fair	Fair	Good
Orange loam	Fair	Good	Good	Good
Orthents-Udults-Mine pits complex	Very poor	Poor	Fair	Fair
Pactolus loamy fine sand	Poor	Fair	Fair	Fair
Pamunkey fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Pamunkey fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Pamunkey fine sandy loam, 6 to 15 percent slopes	Fair	Good	Good	Good
Pamunkey clay loam, 6 to 15 percent slopes, severely eroded.	Fair	Good	Good	Good
Pinkston fine sandy loam, 6 to 25 percent slopes	Poor	Poor	Fair	Poor
Portsmouth silt loam	Very poor	Poor	Poor	Poor
Pouncey sandy loam	Poor	Fair	Fair	Fair
Psamments, gently sloping	Poor	Fair	Fair	Fair
Rains very fine sandy loam	Poor	Fair	Fair	Fair
Riverview silt loam	Poor	Fair	Fair	Good
Roanoke silt loam	Poor	Fair	Fair	Fair
Rumford loamy sand, 0 to 10 percent slopes	Poor	Fair	Fair	Fair
Ruston fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Ruston fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Ruston fine sandy loam, 6 to 10 percent slopes, eroded	Fair	Good	Good	Good
Sassafras fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Sassafras fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
State fine sandy loam, clayey substratum, 0 to 2 percent slopes.	Good	Good	Good	Good
State fine sandy loam, clayey substratum, 2 to 6 percent slopes.	Good	Good	Good	Good
State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded.	Fair	Good	Good	Good
State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes.	Good	Good	Good	Good
Tetotum fine sandy loam	Good	Good	Good	Good
Tetotum loam, flooded	Good	Good	Good	Good
Toccoa fine sandy loam	Fair	Fair	Fair	Good
Turbeville fine sandy loam, 0 to 2 percent slopes	Good	Good	Good	Good
Turbeville fine sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Turbeville fine sandy loam, 6 to 10 percent slopes, eroded.	Fair	Good	Good	Good
Turbeville gravelly fine sandy loam, 2 to 6 percent slopes.	Good	Good	Good	Good
Turbeville gravelly fine sandy loam, 6 to 10 percent slopes.	Fair	Good	Good	Good
Udorthents, clayey	Poor	Poor	Poor	Poor
Udorthents, loamy	Poor	Poor	Poor	Poor
Wedowee sandy loam, 2 to 6 percent slopes	Good	Good	Good	Good
Wedowee sandy loam, 6 to 15 percent slopes	Fair	Good	Good	Good

habitat and for kinds of wildlife—Continued

Elements of wildlife habitat—Continued			Kinds of wildlife—		
Coniferous plants	Wetland plants	Shallow water areas	Openland	Woodland	Wetland
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Fair	Good	Fair	Fair	Fair	Fair.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Fair	Good	Fair	Fair	Fair	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Good	Fair	Fair	Fair	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Fair	Good	Good	Fair	Fair	Good.
Fair	Fair	Fair	Fair	Fair	Fair.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Fair	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Poor	Poor	Poor	Poor	Poor	Poor.
Poor	Poor	Poor	Poor	Poor	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.

wildlife habitat and also for three classes of wildlife habitat.

Habitat suitability ratings

Soils are rated in table 4 for their suitability for producing various kinds of wildlife habitat—openland wildlife habitat, woodland wildlife habitat, and wetland wildlife habitat (*1*). The levels of suitability are expressed by an adjective rating as follows: Good (above average), fair (average), poor (below average), and very poor (impractical). *Good* means that habitats generally are easily created, improved, or maintained; that the soil has few or no limitations that affect habitat management; and that satisfactory results can be expected. *Fair* means that habitats can be created, improved, or maintained but that the soil has moderate limitations that affect management, and that moderate intensity of management and fairly frequent attention are commonly required for satisfactory results. *Poor* means that habitats can be created, improved, or maintained but that the soil has rather severe limitations; that habitat management is difficult and expensive and that it requires intensive effort; and that results are not always satisfactory. *Very poor* means that under the prevailing soil conditions creating, improving, or maintaining habitats is impractical and that unsatisfactory results are probable.

Habitat elements

The seven elements of wildlife habitat listed in table 4 are described in the following paragraphs.

Grain and seed crops refers to domestic grains or other seed-producing annual plants that are suitable as food for wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, buckwheat, soybeans, cowpeas, and sunflowers.

Domestic grasses and legumes refers to forage crops that are commonly planted for wildlife food or cover. Examples are fescue, orchardgrass, bluegrass, timothy, reed canarygrass, clover, alfalfa, lespedeza, trefoil, and crownvetch.

Wild herbaceous plants refers to native or introduced dryland herbaceous grasses and forbs (including weeds) that provide food and cover for wildlife. Examples are partridgepea, bluestem, wild millet, goldenrod, wild strawberry, broomsedge, beggarweed, pokeweed, ragweed, dandelion, wheat grasses, and gramas.

Hardwood trees refers to nonconiferous trees, shrubs, and woody vines that provide wildlife cover or that produce nuts, buds, or other food used extensively by wildlife. Many of these plants have secondary values as nesting or escape cover. These are often established naturally but may be planted or transplanted. These include oak, beech, hickory, maple, birch, locust, dogwood, viburnum, honeysuckle, grape, sumac, blackberries, autumn-olive, multiflora rose, and shrub lespedeza.

Coniferous plants refers to cone-bearing trees, shrubs, or ground cover that furnish wildlife cover or furnish food in the form of browse, seeds, or fruitlike cones. These are commonly established through natural processes but may be planted. Examples are pine, spruce, hemlock, fir, cedar, juniper, larch, yew, and cypress.

Wetland plants refers to annual or perennial wild herbaceous plants that grow on moist to wet sites. They exclude submerged or floating aquatics that produce food or cover used extensively by wetland forms of wildlife. Examples are smartweed, wildrice, rushes, sedges, reeds, cutgrass, arrowhead, and wild millet.

Shallow-water areas refers to impoundments of surface water that have an average depth of less than five feet and that are useful to wildlife. They may be natural areas or they may be formed by dams or levees (sometimes in combination with some excavation), or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, wildlife ponds, and beaver ponds.

Classes of wildlife

The three classes of wildlife habitat listed in table 4 are defined as follows.

Openland wildlife refers to birds and mammals that normally live in areas of cropland, pasture, meadow, and brushy idle land. Examples are rabbit, quail, pheasant, mourning dove, field sparrow, meadowlark, killdeer, red fox, and woodchuck. Ratings in this column represent a weighted average of the suitability ratings for habitat elements consisting of grain and seed crops, domestic grasses and legumes, wild herbaceous plants, and hardwood trees or coniferous plants.

Woodland wildlife refers to birds and mammals that normally live in wooded areas where hardwood trees and shrubs and coniferous trees and shrubs grow. Examples are wild turkey, white-tailed deer, ruffed grouse, gray squirrel, gray fox, raccoon, wood thrush, vireos, warblers, and woodpeckers. Ratings in this column are a weighted average of suitability ratings for habitat elements consisting of domestic grasses and legumes, wild herbaceous plants, hardwood trees, and coniferous plants.

Wetland wildlife refers to birds and mammals that normally live in such wet areas as swamps, marshes, or ponds. Examples are ducks, coots, herons, geese, snipe, rails, kingfishers, mink, muskrat, and beaver. Ratings in this column are a weighted average of suitability ratings for habitat elements consisting of wetland plants and shallow-water areas.

Engineering Uses of the Soils [4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bed-

[4] RICHARD A. GALLO, engineer, Soil Conservation Service, assisted in the preparation of this section.

rock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who:

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering, interpretations for various engineering uses, and engineering test data.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5, 6, and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works. Inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science but are not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3, 8*) used by the SCS engineers, Department of Defense, and others, and the AASHO system adopted by the American Association of State Highway Officials (*2*).

In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL (*5*)

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated AASHO classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Clay" and some of the other terms used in the USDA textural classification are defined in the Glossary.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture (*6*). These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand."

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plow pans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crops.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the first column of this table. Aquents, loamy (AQ), Fluvaquents (FL), Hydraquents (HS), Ochrepts and Udults included in this table because their properties are too variable to estimate.

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHO	
	Feet	*Feet*	*Inches*				
Abell: AbB	3–5	>5	0–11	Fine sandy loam	SM	A–4	
			11–86	Clay loam, gravelly clay loam.	CL, ML-CL	A–6	
Altavista: AfA, AfB	2½–3½	>5	0–19	Fine sandy loam	SM	A–4	
			19–50	Sandy clay loam	SC, CL	A–2, A–6	
			50–103	Sandy loam, gravelly sandy loam.	SM	A–2	0–2
Angie: AgA, AgB, AgB2, AgC2, AgE2.	1½–2½	>5	0–8	Loam	ML	A–4	
			8–15	Clay loam	CL, MH-CH	A–7, A–6	
			15–117	Silty clay	MH-CH	A–7	
Angie variant: Ak	1½–2½	>5	0–7	Loam	ML	A–4	
			7–30	Silty clay loam	ML, CL	A–7	
			30–106	Very gravelly silty clay loam.	GM, SC	A–2, A–4	
Appling: AmB, AmC2, AmE2, AoC3.	>5	>5	0–12	Fine sandy loam	SM, SC	A–4, A–2	
			12–58	Clay	MH	A–7	
			58–94	Sandy clay loam	SC, SM, ML-CL	A–2, A–6, A–7	
Ashlar: AsD, AsE	>5	2–3½	0–14	Gravelly sandy loam, sandy loam.	SM	A–2	
			14–40	Sandy loam, gravelly sandy loam.	SM	A–1, A–2	0–2
Atlee: At	1½–2½	>5	0–22	Loam, clay loam	ML	A–4	
			[2] 22–54	Clay loam	CL, ML-CL	A–6, A–7	
			54–102	Clay	CL	A–7	
Bertie: Be	[3] 1–1½	>5	0–9	Fine sandy loam	SM, ML	A–4	
			9–36	Sandy clay loam	SC, CL	A–4	
			36–59	Fine sandy loam	SM	A–2, A–4	
			59–82	Stratified sand to very gravelly fine sand.	GW, GM, SW, SM	A–1, A–2	0–2
Bourne: BoA, BoB, BoC	1½–2½	>5	0–18	Fine sandy loam, sandy clay loam.	SM, SC	A–4	
			[2] 18–44	Fine sandy loam, sandy clay loam.	SM, SC, ML	A–4	
			44–86	Sandy clay loam, sandy loam.	SC, SM-SC	A–7, A–6	
Buncombe: Bu	[3] >5	>5	0–48	Loamy fine sand	SM	A–2	
			48–78	Stratified sand to very gravelly sand.	SM, SP-SM	A–2	0–5
Caroline: CaB2, CaC2, CaD2, CbC3.	>5	>5	0–5	Very fine sandy loam	ML	A–4	
			5–21	Clay loam	CL	A–6, A–7	
			21–61	Silty clay, clay	MH, CH	A–7	
			61–134	Sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A–4, A–6	
*Cecil: CeC2, CeD2, CfD3— For Turbeville part of CfD3, see Turbeville series	>5	>5	0–9	Fine sandy loam	SM, SC	A–4, A–2	
			9–44	Clay	MH	A–7	
			44–114	Clay loam, sandy clay loam.	SM, MH, ML-CL	A–5, A–6, A–7	
Chastain: Cg	[3] 0–1	>5	0–5	Silt loam	ML, CL	A–4, A–6	
			5–59	Clay	CH	A–7	
			59–65	Gravelly sandy clay loam	SC	A–6	0–2

significant to engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring (OUD, OUF), Orthents-Udults-Mine pits (OW), Psamments, gently sloping (PTB), Udorthents (UD, UE), and Urban land (UR) are not The symbol > means greater than, the symbol < means less than]

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				Inches per inch of soil		*pH*			
90–95	90–95	65–75	36–40	2.0–6.0	0.10–0.15	5.1–5.5	Low	(1)	High.
75–95	70–90	60–90	55–70	0.6–2.0	0.14–0.18	5.1–5.5	Moderate	High	High.
95–100	90–100	65–75	36–40	2.0–6.0	0.10–0.15	4.5–5.5	Low	(1)	High.
95–100	90–100	70–90	30–55	0.6–2.0	0.13–0.16	4.5–5.5	Moderate	High	High.
75–95	70–90	40–60	20–35	2.0–6.0	0.06–0.10	4.5–5.5	Low	High	High.
100	100	85–100	60–95	0.6–2.0	0.14–0.17	5.1–5.5	Low	(1)	High.
100	100	90–100	70–100	0.06–0.2	0.16–0.19	5.1–5.5	Moderate	High	High.
100	95–100	90–100	85–95	0.06–0.2	0.12–0.15	5.1–5.5	High	High	High.
100	100	85–100	60–95	0.6–2.0	0.14–0.17	5.1–5.5	Low	(1)	High.
100	95–100	90–100	80–95	0.06–0.2	0.16–0.19	5.1–5.5	Moderate	High	High.
60–75	35–50	35–50	30–45	0.06–0.2	0.08–0.13	5.1–5.5	Moderate	High	High.
90–100	85–100	65–85	30–45	2.0–6.0	0.10–0.15	4.5–5.5	Low	(1)	High.
95–100	90–100	80–100	65–95	0.6–2.0	0.10–0.14	4.5–5.5	Moderate	High	High.
95–100	75–90	60–80	25–55	0.6–2.0	0.13–0.16	4.5–5.5	Moderate	High	High.
75–90	60–85	40–60	20–35	2.0–6.0	0.08–0.12	4.5–5.5	Low	Low	High.
60–85	50–80	30–55	15–30	2.0–6.0	0.06–0.10	4.5–5.5	Low	Low	High.
100	100	85–100	60–90	0.6–2.0	0.16–0.19	4.5–5.5	Low	(1)	High.
100	100	90–100	70–85	0.2–0.6	0.10–0.13	4.5–5.5	Low	High	High.
100	100	90–100	75–95	0.2–0.6	0.10–0.14	4.5–5.5	Moderate	High	High.
95–100	95–100	65–100	36–55	2.0–6.0	0.10–0.15	4.5–5.5	Low	(1)	High.
95–100	95–100	80–100	36–55	0.2–0.6	0.13–0.16	4.5–5.5	Low	High	High.
95–100	95–100	70–100	30–50	0.2–0.6	0.10–0.15	4.5–5.5	Low	High	High.
50–85	30–85	20–40	2–15	2.0–6.0	0.04–0.06	4.5–5.5	Low	High	High.
95–100	95–100	70–90	36–50	0.6–2.0	0.10–0.15	4.5–5.0	Low	Moderate	High.
95–100	95–100	70–90	36–70	<0.06–0.2	0.06–0.08	4.5–5.0	Low	Moderate	High.
95–100	95–100	60–80	40–50	0.2–0.6	0.12–0.16	4.5–5.0	Low	Moderate	High.
90–100	90–100	45–75	15–30	>6.0	0.06–0.08	4.5–5.5	Low	Low	High.
45–95	35–90	20–65	7–20	>6.0	0.03–0.08	4.5–5.5	Low	Low	High.
95–100	95–100	80–95	51–65	0.6–2.0	0.15–0.18	4.5–5.0	Low	(1)	High.
95–100	95–100	85–100	65–80	0.2–0.6	0.16–0.19	4.5–5.0	Moderate	High	High.
95–100	95–100	85–100	80–95	0.2–0.6	0.10–0.15	4.5–5.0	Moderate	High	High.
95–100	95–100	70–90	40–55	0.2–2.0	0.12–0.16	4.5–5.0	Low	High	High.
85–100	85–100	65–85	30–45	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
95–100	90–100	80–100	65–95	0.6–2.0	0.10–0.14	4.5–5.0	Moderate	High	High.
95–100	75–90	60–80	45–60	0.6–2.0	0.13–0.19	4.5–5.0	Moderate	High	High.
95–100	90–100	85–100	65–90	0.6–2.0	0.17–0.20	4.5–5.0	Moderate	(1)	High.
95–100	90–100	80–100	65–95	0.06–0.2	0.10–0.14	4.5–5.0	Moderate	High	High.
65–80	50–70	40–60	35–40	0.2–0.6	0.12–0.15	4.5–5.0	Low	High	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHO	
	Feet	*Feet*	*Inches*				
*Chewacla: Ch, Ck, Cm—For Riverview part of Cm, see Riverview series.	[3] 1½–2½	>5	0–44	Silt loam	ML, CL	A–4	
			44–95	Loam	ML, CL	A–4, A–6	
Colfax: CoB	[3] 1–1½	>4	0–6	Fine sandy loam	SM, ML	A–4	
			60–30	Sandy clay loam	SC, CL	A–4,	
			[2] 30–54	Sandy clay loam, sandy loam.	SC, CL	A–2, A–4	
Coxville: Cp	[3] 0–1	>5	0–8	Silt loam	ML, CL	A–4, A–6	
			8–93	Clay	CL, CH	A–7	
Creedmoor: CvB, CvB2, CvC2.	1½–2½	>5	0–10	Sandy loam	SM	A–2, A–4	
			10–20	Sandy clay loam, clay loam.	CH	A–7	
			20–48	Clay	CH	A–7	
			48–78	Sandy loam	SC, SM	A–2	0–5
Duplin: DuB2, DuC2, DuD2, DvA, DwC3.	1½–2½	>5	0–10	Very fine sandy loam	ML	A–4	
			10–110	Clay	MH, CH	A–7	
			110–128	Sandy clay loam	SC, CL	A–6	
Faceville: FaA, FaB2	>5	>5	0–13	Fine sandy loam	SM, ML	A–4	
			13–126	Clay loam	CL	A–6, A–7	
Forestdale: Fo	[3] 0–1	>5	0–7	Silt loam	ML, CL	A–4, A–6	
			7–48	Clay	MH, CH	A–7	
			48–87	Stratified gravelly sand to sandy clay loam.	GM, SM, SC	A–1, A–2, A–6	0–2
Helena: HeB, HeB2, HeC2	2–3	>5	0–10	Fine sandy loam	SM, ML	A–4	
			10–40	Clay	CH, MH	A–7	
			40–100	Clay loam	CL, MH	A–7	
Kalmia: KaA, KaC	[3] >5	>5	0–21	Fine sandy loam, loam	SM, ML	A–4	
			21–40	Sandy clay loam	SC, CL	A–2, A–4	
			40–84	Stratified loamy fine sand to gravelly sand.	GM, SM	A–2	
Kempsville: KeA, KeB, KeC2, KeD2, KfA[3], KfB[3], KgA, KgB, KgC2.	>5	>5	0–17	Fine sandy loam	SM, ML	A–4	
			17–80	Sandy clay loam	SC, CL	A–6	
			80–108	Loamy fine sand	SM	A–2	
*Kinston: Km, Kn—For Mantachie part of Kn, see Mantachie series.	[3] 0–1	>5	0–6	Silt loam	ML, CL	A–6, A–7	
			6–74	Clay loam, sandy clay loam.	CL, ML, SM	A–6, A–4	
			74–120	Stratified sandy clay loam and fine sandy loam.	SM, CL	A–4, A–6	
Lenoir: Le	[3] 1–1½	>5	0–14	Silt loam, silty clay loam	ML, CL	A–4, A–6	
			14–110	Clay, silty clay	MH, CH	A–7	
Lynchburg: Ly	1–1½	>5	0–14	Very fine sandy loam	ML	A–4	
			14–104	Clay loam	ML, CL	A–6, A–7	
*Mantachie: Mc—For Chastain part, see Chastain series.	[3] 1–1½	>5	0–17	Loam, very fine sandy loam.	ML, CL	A–4, A–6	
			17–47	Clay loam, silty clay loam.	CL, MH	A–6, A–7	
			47–91	Stratified sandy clay loam, fine sandy loam, silty clay loam.	SM, CL, CH	A–4, A–6, A–7	

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				Inches per inch of soil		*pH*			
95–100	95–100	85–95	65–85	0.6–2.0	0.17–0.20	5.1–6.0	Moderate	High	Moderate.
90–100	95–100	80–95	55–75	0.6–2.0	0.14–0.17	5.1–6.0	Low	High	Moderate.
95–100	95–100	65–90	36–55	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
95–100	95–100	75–90	40–55	0.6–2.0	0.13–0.16	4.5–5.0	Low	High	High.
95–100	90–100	55–90	25–55	0.06–0.2	0.04–0.08	4.5–5.0	Low	High	High.
100	100	90–100	70–90	0.6–2.0	0.17–0.20	4.5–5.0	Low	(1)	High.
100	100	90–100	75–95	0.2–0.6	0.10–0.14	4.5–5.0	Moderate	High	High.
95–100	95–100	55–70	30–40	2.0–6.0	0.08–0.12	4.5–5.0	Low	(1)	High.
95–100	95–100	80–100	40–80	0.2–0.6	0.13–0.19	4.5–5.0	Moderate	High	High.
95–100	95–100	85–100	70–95	<0.06	0.10–0.14	4.5–5.0	High	High	High.
80–95	75–90	45–60	20–35	0.2–0.6	0.08–0.12	4.5–5.0	Low	High	High.
100	100	85–100	50–65	0.6–2.0	0.15–0.18	4.5–5.0	Low	(1)	High.
100	100	90–100	70–95	0.06–0.2	0.10–0.14	4.5–5.0	Moderate	High	High.
100	100	80–90	36–55	0.6–2.0	0.13–0.16	4.5–5.0	Low	High	High.
95–100	95–100	65–85	36–55	2.0–6.0	0.10–0.15	4.5–5.5	Low	(1)	High.
95–100	95–100	85–100	65–80	0.6–2.0	0.16–0.19	4.5–5.5	Moderate	High	High.
95–100	95–100	85–100	65–90	0.6–2.0	0.17–0.20	4.5–5.5	Low	(1)	High.
95–100	95–100	85–100	70–95	<0.06	0.10–0.14	4.5–5.5	High	High	High.
50–85	50–80	25–60	10–40	2.0–6.0	0.04–0.12	4.5–5.5	Low	High	High.
95–100	95–100	65–85	40–55	0.6–2.0	0.10–0.15	4.5–5.0	Low	(1)	High.
95–100	95–100	80–100	70–95	0.06–0.2	0.10–0.14	4.5–5.0	High	High	High.
95–100	95–100	70–90	50–70	0.2–0.6	0.16–0.19	4.5–5.0	Moderate	High	High.
90–100	90–100	60–95	36–70	2.0–6.0	0.10–0.17	4.5–5.0	Low	Moderate	High.
90–100	90–100	70–90	30–55	0.6–2.0	0.13–0.16	4.5–5.0	Low	Moderate	High.
50–85	40–80	25–60	10–30	>6.0	0.04–0.08	4.5–5.0	Low	Moderate	High.
100	100	70–85	40–55	2.0–6.0	0.10–0.15	4.5–5.5	Low	Moderate	High.
100	100	80–90	36–55	0.6–2.0	0.13–0.16	4.5–5.5	Low	Moderate	High.
100	100	50–75	15–30	>6.0	0.06–0.08	4.5–5.5	Low	Moderate	High.
95–100	95–100	85–100	65–90	2.0–6.0	0.17–0.20	4.5–5.0	Low	(1)	High.
95–100	95–100	75–100	40–80	0.6–2.0	0.13–0.19	4.5–5.0	Low	High	High.
95–100	95–100	65–90	40–55	0.6–2.0	0.10–0.16	4.5–5.0	Low	High	High.
100	100	90–100	70–95	0.6–2.0	0.16–0.20	4.5–5.0	Low	High	High.
100	100	90–100	75–100	0.06–0.2	0.10–0.15	4.5–5.0	Moderate	High	High.
100	100	85–100	50–70	0.6–2.0	0.15–0.18	4.5–5.0	Low	High	High.
100	100	95–100	60–80	0.6–2.0	0.16–0.19	4.5–5.0	Low	High	High.
100	100	85–95	50–75	0.6–2.0	0.14–0.18	4.5–5.0	Low	High	High.
100	100	90–100	70–95	0.6–2.0	0.16–0.19	4.5–5.0	Low	High	High.
95–100	95–100	65–100	36–90	0.6–2.0	0.10–0.19	4.5–5.0	Low	High	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHO	
	Feet	*Feet*	*Inches*				
Mayodan: MdB2	>5	>4	0–11	Fine sandy loam	SM, ML	A–4	
			11–49	Clay	SC, MH	A–7	0–2
			49–101	Silty clay loam	MH	A–7, A–6	4–10
Myatt: My	[3] 0–1	>5	0–15	Fine sandy loam	SM, ML	A–4	
			15–37	Clay loam	ML, CL	A–4, A–6	
			37–67	Fine sandy loam	SM, ML	A–4	
			67–94	Loamy fine sand, sand	SP, SM	A–2	
Norfolk: NoA, NoB, NoC	>5	>5	0–18	Fine sandy loam	SM, ML	A–4	
			18–63	Sandy clay loam	SC, CL	A–6	
			63–115	Clay	MH, CH	A–7	
Orange: Ov	[3] 1–1½	3½–5	0–12	Loam	ML, CL	A–4, A–6	
			12–36	Clay	CH	A–7	
Pactolus: Pa	[3] 1½–3½	>5	0–41	Loamy fine sand	SM	A–2	
			41–66	Sand	SM, SP	A–2, A–3	
Pamunkey: PmA, PmB, PmD, PnC3.	>5	>5	0–9	Fine sandy loam	SM, ML	A–4	
			9–118	Sandy clay loam	SC, CL	A–2, A–6	
Pinkston: PoE	>5	2–3	0–11	Fine sandy loam	SM, ML	A–4	0–3
			11–36	Cobbly fine sandy loam	GM, SM	A–1, A–2	15–25
Portsmouth: Pr	[3] 0–1	>5	0–20	Silt loam	ML	A–4	
			20–33	Sandy clay loam	SC, CL	A–2, A–6	
			33–95	Loamy fine sand, fine sand.	SM	A–2	
Pouncey: Ps	[3] 0–1	1½–3½	0–10	Sandy loam	SM	A–2, A–4	
			10–25	Clay	CH, MH	A–7	
Rains: Ra	[3] 0–1	>5	0–11	Very fine sandy loam	SM, ML	A–4	
			11–49	Clay loam	CL, ML	A–6, A–7	
			49–96	Clay	MH, CH	A–7	
Riverview: Re	[3] >4	>5	0–104	Silt loam	ML, CL	A–4	
Roanoke: Ro	[3] 0–1	>5	0–6	Silt loam	ML, CL	A–4	
			6–90	Clay, silty clay	MH, CH	A–7	
Rumford: RrC	>5	>5	0–18	Loamy sand	SM	A–2	
			18–38	Sandy loam	SM, SC	A–2, A–4	
			38–82	Loamy fine sand, gravelly sandy loam.	SM, GM	A–1, A–2	
Ruston: RuA, RuB, RuC2	>5	>5	0–11	Fine sandy loam	SM, ML	A–4	
			11–142	Sandy clay loam, clay loam.	SC, CL	A–2, A–6	
Sassafras: SsA, SsB	>5	>5	0–16	Fine sandy loam	SM, ML	A–4	
			16–38	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A–4, A–6	
			38–80	Fine sandy loam, gravelly sandy clay loam.	SM, SC, GM	A–2, A–4	
State: StA, StB, StC2, SvB	>5	>5	0–11	Fine sandy loam	SM, SC	A–2, A–4	
			11–60	Sandy clay loam, clay loam.	SC, CL	A–2, A–6	
			60–104	Clay	SC, MH, CH	A–7	
Tetotum: Td[2], Te	1½–2½	>5	0–16	Fine sandy loam	SM, ML	A–2, A–4	
			16–93	Sandy clay loam	SC, CL	A–2, A–6	

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
					Inches per inch of soil	*pH*			
95–100	95–100	65–85	40–55	2.0–6.0	0.10–0.15	4.5–5.5	Low	(1)	High.
75–85	60–75	50–75	45–75	0.6–2.0	0.10–0.14	4.5–5.5	Moderate	High	High.
90–100	75–100	35–70	30–65	0.6–2.0	0.10–0.16	4.5–5.5	Moderate	High	High.
100	100	70–95	40–55	0.6–2.0	0.10–0.15	4.5–5.5	Low	(1)	High.
100	100	90–100	55–70	0.06–0.2	0.16–0.19	4.5–5.5	Low	High	High.
100	100	75–100	40–55	0.6–2.0	0.10–0.15	4.5–5.5	Low	High	High.
90–100	90–100	45–70	4–30	2.0–6.0	0.04–0.08	4.5–5.5	Low	High	High.
95–100	95–100	65–85	40–55	2.0–6.0	0.10–0.15	4.5–6.0	Low	Moderate	High.
95–100	95–100	75–90	36–55	0.6–2.0	0.13–0.16	4.5–6.0	Low	Moderate	High.
95–100	95–100	85–100	70–95	0.2–0.6	0.10–0.14	4.5–6.0	Moderate	Moderate	High.
95–100	95–100	80–95	55–75	0.6–2.0	0.14–0.17	4.5–5.0	Low	(1)	High.
95–100	95–100	85–100	70–95	0.06–0.2	0.10–0.14	4.5–5.0	High	High	High.
85–100	85–100	40–75	15–30	>6.0	0.06–0.08	4.5–5.0	Low	Low	High.
85–100	85–100	40–70	4–15	>6.0	0.04–0.06	4.5–5.0	Low	Low	High.
85–100	85–100	60–85	40–55	2.0–6.0	0.10–0.15	5.1–6.5	Low	(1)	Moderate.
85–100	85–100	70–90	30–55	0.6–2.0	0.13–0.16	5.1–6.5	Low	Moderate	Moderate.
90–100	85–100	60–85	36–55	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
50–70	40–60	30–50	15–35	2.0–6.0	0.04–0.09	4.5–5.0	Low	Low	High.
95–100	95–100	85–100	65–90	0.6–2.0	0.10–0.17	<4.5	Low	High	High.
95–100	95–100	75–90	30–55	0.6–2.0	0.13–0.16	<4.5	Low	High	High.
95–100	95–100	45–80	15–35	2.0–6.0	0.06–0.08	<4.5	Low	High	High.
95–100	90–100	60–75	25–40	0.6–2.0	0.08–0.12	4.5–5.5	Low	(1)	High.
95–100	90–100	80–90	70–85	0.06–0.2	0.10–0.14	4.5–5.5	High	High	High.
95–100	90–100	80–95	45–65	0.6–2.0	0.15–0.18	4.5–5.0	Low	(1)	High.
95–100	90–100	85–100	65–80	0.6–2.0	0.16–0.19	4.5–5.0	Low	High	High.
95–100	90–100	80–100	70–95	0.2–0.6	0.10–0.14	4.5–5.0	Moderate	High	High.
95–100	95–100	85–100	65–90	0.6–2.0	0.17–0.20	4.5–5.5	Low	Moderate	Moderate.
100	100	90–100	70–90	0.6–2.0	0.17–0.20	4.5–5.0	Low	(1)	High.
95–100	95–100	85–100	70–95	0.06–0.2	0.10–0.15	4.5–5.0	High	High	High.
95–100	90–100	45–75	15–30	>6.0	0.06–0.08	4.5–5.0	Low	(1)	High.
95–100	90–100	55–70	25–40	>6.0	0.08–0.12	4.5–6.0	Low	Low	High.
50–85	50–80	25–55	10–30	>6.0	0.04–0.10	4.5–6.0	Low	Low	High.
90–100	85–100	60–85	40–55	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
90–100	85–100	70–100	30–70	0.6–2.0	0.13–0.19	4.5–5.0	Low	Moderate	High.
90–100	85–100	60–85	40–55	2.0–6.0	0.10–0.15	4.5–6.0	Low	(1)	High.
90–100	85–100	60–90	36–55	0.6–2.0	0.10–0.16	4.5–6.0	Low	Moderate	High.
50–85	50–80	35–70	20–45	0.6–2.0	0.06–0.14	4.5–6.0	Low	Moderate	High.
70–90	60–85	40–75	25–45	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
70–90	60–85	50–85	20–60	0.6–2.0	0.13–0.19	4.5–5.0	Low	Moderate	High.
70–90	60–85	55–85	45–75	0.6–2.0	0.10–0.14	4.5–5.0	Moderate	Moderate	High.
80–100	75–100	50–85	30–55	2.0–6.0	0.10–0.15	4.5–5.0	Low	(1)	High.
80–100	75–100	60–90	25–55	0.6–2.0	0.13–0.16	4.5–5.0	Low	High	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Seasonal high water table	Bedrock			Unified	AASHO	
	Feet	*Feet*	*Inches*				
Toccoa: To	[3] >4	>5	0–102	Fine sandy loam, very fine sandy loam.	SM, ML	A–4	
Turbeville: TuA, TuB, TuC2, TvB, TvC.	>5	>5	0–12	Fine sandy loam, sandy clay loam.	SM, ML, SC	A–2, A–4	
			12–92	Clay	MH, CH	A–7	
Wedowee: WeB, WeD	>5	>5	0–9	Sandy loam	SM	A–2, A–4	
			9–91	Clay loam	CL, MH	A–6, A–7	

[1] Not rated.
[2] Fragipan.

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in to other series that appear in the first column of this table. Aquents, loamy (AQ), Fluvaquents (FL), Hydraquents (HS), Ochrepts and Udults included in this table because their properties are too variable to estimate]

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
Abell: AbB	Fair: silty	Unsuited	Fair in the upper 24 inches.	Seasonal high water table; moderate permeability; seepage.
Altavista: AfA, AfB	Fair: silty	Fair: below a depth of about 4 feet.	Fair in the upper 24 inches.	Seasonal high water table; moderate permeability; seepage.
Angie: AgA, AgB, AgB2, AgC2, AgE2.	Poor: silty	Unsuited	Poor: hard to reclaim borrow area.	Seasonal high water table; slow permeability.
Angie variant: Ak	Poor: silty	Unsuited	Poor: hard to reclaim borrow area.	Seasonal high water table; slow permeability; concretionary subsoil.
Appling: AmB, AmC2, AmE2, AoC3.	Fair: clayey suboil; moderate shrink-swell potential; slope.	Unsuited	Poor: clayey; hard to reclaim borrow area.	Moderate permeability; seepage.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					Uncoated steel	Concrete
				Inches per inch of soil		*pH*			
90–100	90–100	60–95	36–65	2.0–6.0	0.10–0.18	5.1–6.0	Low	Low	Moderate.
70–100	60–100	40–90	25–55	0.6–2.0	0.10–0.16	4.5–5.5	Low	(1)	High.
70–100	60–100	55–100	50–95	0.6–2.0	0.10–0.14	4.5–5.5	Moderate	High	High.
95–100	95–100	55–70	30–40	2.0–6.0	0.08–0.12	4.5–5.0	Low	(1)	High.
95–100	95–100	85–100	65–80	0.6–2.0	0.16–0.19	4.5–5.0	Moderate	Moderate	High.

[3] Subject to flooding.

interpretations

such mapping units have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring (OUD, OUF), Orthents-Udults-Mine pits (OW), Psamments, gently sloping (PTB), Udorthents (UD, UE), and Urban land (UR) are not

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Medium strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Moderately well drained; moderate permeability.	High available water capacity; seasonal high water table; moderate intake rate.	Short slopes; erodible; seepage.	Moderately well drained seepage.	Fair trafficability; seasonal high water table; high soil moisture.
Medium strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Moderately well drained; moderate permeability.	Medium available water capacity; seasonal high water table; moderate intake rate.	(1)	Moderately well drained.	Fair trafficability; seasonal high water table; high soil moisture.
High compressibility, low strength, permeability, and susceptibility to piping; poor compaction.	Moderately well drained; slow permeability.	Medium available water capacity; seasonal high water table; slow intake rate; erodible.	(2)	Moderately well drained; erodible on slopes.	Poor trafficability; seasonal high water table; high soil moisture; clayey subsoil.
Medium to low strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Moderately well drained; slow permeability.	Medium available water capacity; seasonal high water table; slow intake rate.	(1)	Moderately well drained.	Poor trafficability; seasonal high water table; high soil moisture.
Low to medium strength, permeability, and susceptibility to piping; medium to high compressibility; fair compaction.	Well drained	Medium available water capacity; moderate intake rate; erodible.	(2)	Erodible on slopes	Fair trafficability; clayey subsoil; moderate soil moisture.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
Ashlar: AsD, AsE	Poor: rock at a depth of 2 to 3½ feet; slope.	Unsuited	Poor: hard to reclaim borrow area.	Moderately rapid permeability; seepage; rock at a depth of 2 to 3½ feet.
Atlee: At	Fair: silty	Unsuited	Poor: hard to reclaim borrow area.	Seasonal high water table; moderately slow permeability.
Bertie: Be	Fair: silty; somewhat poorly drained.	Fair below a depth of about 5 feet.	Fair in the upper 36 inches.	Seasonal high water table; moderately slow permeability; seepage.
Bourne: BoA, BoB, BoC	Fair: silty	Unsuited	Poor: hard to reclaim borrow area; fragipan.	Seasonal high water table; slow to very slow permeability.
Buncombe: Bu	Good	Poor: silty	Poor: sandy	Rapid permeability; seepage.
Caroline: CaB2, CaC2, CaD2, CbC3.	Fair: clayey subsoil; moderate shrink-swell potential.	Unsuited	Poor: clayey; hard to reclaim borrow area.	Moderately slow permeability.
*Cecil: CeC2, CeD2, CfD3. For Turbeville part of CfD3, see Turbeville series.	Fair: clayey subsoil; moderate shrink-swell potential.	Unsuited	Poor: clayey; hard to reclaim borrow area.	Moderate permeability
Chastain: Cg	Poor: clayey subsoil; high shrink-swell potential; poorly drained.	Unsuited	Poor: thin surface layer; poorly drained.	Seasonal high water table; slow permeability; seepage.

interpretations—Continued

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Medium to low strength, compressibility, and permeability; medium to high susceptibility to piping; fair to good compaction.	Somewhat excessively drained to excessively drained.	Low available water capacity; rapid intake rate; rock at a depth of 2 to 3½ feet; erodible.	Moderately rapid permeability; rock at a depth of 2 to 3½ feet; slope.	(1)	Good trafficability; low plasticity; low soil moisture.
Medium to low strength, compressibility, permeability and susceptibility to piping; fair compaction.	Moderately well drained; moderately slow permeability; fragipan.	Medium available water capacity; seasonal high water table; slow intake rate; fragipan.	(1)	Moderately well drained; fragipan.	Poor trafficiablity; seasonal high water table; slow intake rate; fragipan.
Medium to low strength, compressbility and permeability; medium to high susceptibility to piping; fair compaction.	Somewhat poorly drained; moderately slow permeability; flooding.	Medium available water capacity; seasonal high water table; moderate intake rate; flooding.	(1)	Somewhat poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture.
Medium to low strength, compressibility, and permeability; medium susceptibility to piping; fair compaction.	Moderately well drained; slow to very slow permeability; fragipan.	Low available water capacity; seasonal high water table; slow intake rate; fragipan.	Slow to very slow permeability; erodible; siltation of channels; fragipan.	Moderately well drained; low available water capacity; erodible; fragipan.	Poor trafficability; seasonal high water table; high soil moisture; fragipan.
Medium to high strength; low to medium compressibility and permeability; medium to high susceptibility to piping; fair to good compaction.	Excessively drained; flooding.	Low available water capacity; rapid intake rate; flooding.	(1)	Low available water capacity; flooding; erodible; siltation of channels.	Good trafficability; low plasticity; low soil moisture; flooding.
Medium to low strength, permeability, and susceptibility to piping; medium to high compressibility; fair compaction.	Well drained	Medium available water capacity; slow intake rate; erodible.	(2)	Erodible on slopes	Fair trafficability; clayey subsoil; moderate soil moisture.
Low to medium strength and susceptibility to piping; medium to high compressibility; low permeability; fair to poor compaction.	Well drained	Medium available water capacity; moderate intake rate; erodible.	(2)	Erodible on slopes	Fair trafficability; clayey subsoil; moderate soil moisture.
Low to medium strength, permeability, and susceptibility to piping; high compressibility; poor compaction.	Poorly drained; slow permeability; flooding.	Medium available water capacity; slow intake rate; flooding.	(1)	Poorly drained; seepage; flooding; siltation of channels.	Poor trafficability; seasonal high water table; clayey subsoil; high soil moisture.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
*Chewacla: Ch, Ck, Cm. For Riverview part of Cm, see Riverview series.	Fair: silty; somewhat poorly drained.	Unsuited	Good in the upper 48 inches.	Seasonal high water table; moderate permeability; seepage.
Colfax: CoB	Fair: silty; somewhat poorly drained.	Unsuited	Poor: hard to reclaim borrow area; fragipan.	Seasonal high water table; slow permeability; fragipan.
Coxville: Cp	Poor: clayey subsoil; high shrink-swell potential; poorly drained.	Unsuited	Poor: thin surface layer; poorly drained.	Seasonal high water table; moderately slow permeability.
Creedmoor: CvB, CvB2, CvC2.	Poor: plastic, clayey subsoil; high shrink-swell potential.	Unsuited	Poor: clayey; hard to relcaim borrow area.	Seasonal high water table; very slow permeability; seepage.
Duplin: DuB2, DuC2, DuD2, DvA, DwC3.	Poor: clayey subsoil	Unsuited	Poor: clayey; hard to reclaim borrow area.	Seasonal high water table; slow permeability.
Faceville: FaA, FaB2	Fair: clayey subsoil; moderate shrink-swell potential.	Unsuited	Fair: clayey	Moderate permeability; seepage.
Forestdale: Fo	Poor: plastic, clayey subsoil; high shrink-swell potential; poorly drained.	Fair below a depth of about 4 feet.	Poor: thin surface layer; poorly drained.	Seasonal high water table; very slow permeability; seepage.
Helena: HeB, HeB2, HeC2.	Poor: plastic clayey subsoil; high shrink-swell potential.	Unsuited	Poor: clayey; hard to reclaim borrow area.	Seasonal high water table; slow permeability; seepage.
Kalmia: KaA, KaC	Fair: silty	Fair below a depth of about 3½ feet.	Good in the upper 24 inches.	Moderate permeability; seepage.

interpretations—Continued

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Low to medium strength, compressibility, and permeability; medium to high susceptibility to piping; fair compaction.	Somewhat poorly drained; moderate permeability; flooding.	High available water capacity; moderate intake rate; flooding.	(1)	Somewhat poorly drained; seepage; flooding; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture.
Low to medium strength, compressibility, and permeability; medium susceptibility to piping; fair to good compaction.	Somewhat poorly drained; slow permeability; fragipan.	Low available water capacity; moderate intake rate; fragipan.	(1)	Somewhat poorly drained; low available water capacity; fragipan.	Poor trafficability; seasonal high water table; high soil moisture; fragipan.
Low to medium strength; permeability, and susceptibility to piping; high compressibility; poor compaction.	Poorly drained; moderately slow permeability; flooding.	Medium available water capacity; slow intake rate; flooding.	(1)	Poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; clayey subsoil; high soil moisture; flooding.
Low strength, permeability, and susceptibility to piping; high compressibility; poor to fair compaction.	Moderately well drained; very slow permeability.	Medium available water capacity; slow intake rate.	Very slow permeability; plastic, clayey subsoil.	Moderately well drained; medium available water capacity; erodible; siltation of channels.	Poor trafficability; seasonal high water table; plastic, clayey subsoil; high soil moisture.
Medium to low strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Moderately well drained, slow permeability.	Medium available water capacity; slow intake rate.	Slow permeability; erodible; siltation of channels.	Moderately well drained; medium available water capacity; erodible; siltation of channels.	Poor trafficability; seasonal high water table; clayey subsoil; high soil moisture.
Medium to low strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Well drained	(2)	(2)	(2)	Fair trafficability; moderate soil moisture.
Medium to low strength, high compressib lity; low permeability and susceptibility to piping; fair to poor compaction.	Poorly drained; very slow permeability; flooding.	(1)	(1)	Poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; plastic, clayey subsoil; high soil moisture; flooding.
Low strength, permeability, and susceptibility to piping; high compressibility; poor to fair compaction.	Moderately well drained; slow permeability.	Medium available water capacity; slow intake rate.	Slow permeability; plastic, clayey subsoil.	Moderately well drained; medium available water capacity; erodible; siltation of channels.	Poor trafficability; seasonal high water table; plastic, clayey subsoil; high soil moisture.
Medium strength, low to medium compressibility, permeability, and susceptibility to piping; good compaction.	Well drained; flooding.	Medium available water capacity; moderate intake rate; flooding.	Flooding; siltation of channels.	Erodible on slopes; flooding; siltation of channels.	Fair trafficability; moderate soil moisture; flooding.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
Kempsville: KeA, KeB, KeC2, KeD2, KfA, KfB, KgA, KgB, KgC2. (KfA and KfB are subject to overflow.)	Fair: silty	Poor: silty	Good in the upper 24 inches.	Moderate permeability; seepage.
*Kinston: Km, Kn. For Mantachie part of Kn, see Mantachie series.	Poor: silty; poorly drained.	Unsuited	Fair in the upper 36 inches.	Seasonal high water table; moderate permeability; seepage.
Lenoir: Le	Poor: clayey subsoil; somewhat poorly drained.	Unsuited	Poor: hard to reclaim borrow area.	Seasonal high water table; slow permeability.
Lynchburg: Ly	Fair: silty; somewhat poorly drained.	Unsuited	Poor: hard to reclaim borrow area.	Seasonal high water table; moderate permeability; seepage.
*Mantachie: Mc. For Chastain part, see Chastain series.	Poor: silty	Unsuited	Fair in the upper 36 inches.	Seasonal high water table; moderate permeability; seepage.
Mayodan: MdB2	Fair: clayey subsoil; moderate shrink-swell potential.	Unsuited	Poor: clayey; hard to reclaim borrow area.	Moderate permeability; seepage.
Myatt: My	Poor: silty; poorly drained.	Poor: sand in spots below a depth of about 5 feet.	Poor: poorly drained	Seasonal high water table; slow permeability; seepage.
Norfolk: NoA, NoB, NoC.	Fair: silty	Unsuited	Good in the upper 24 inches.	Moderate permeability
Orange: Ov	Poor: plastic, clayey subsoil; high shrink-swell potential.	Unsutied	Poor: thin surface layer; hard to reclaim borrow area.	Seasonal high water table; slow permeability.

interpretations—Continued

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Medium to low strength, compressibility, permeability, and susceptibility to piping; fair to good compaction.	Well drained	(2)	(2)	(2)	Good trafficability; moderate soil moisture.
Medium strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Poorly drained; moderate permeability; flooding.	High available water capacity; moderate intake rate; flooding.	(1)	Poorly drained; flooding; seepage; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture; flooding.
Low to medium strength, permeability, and susceptibility to piping; high compressibility; poor compaction.	Somewhat poorly drained; slow permeability; flooding.	Medium available water capacity; slow intake rate; flooding.	(1)	Somewhat poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture; flooding.
Medium strength, compressibility, permeability, and susceptibility to piping; fair compaction.	Somewhat poorly drained; moderate permeability.	High available water capacity; moderate intake rate.	(1)	Somewhat poorly drained; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture.
Medium to low strength, permeability, and susceptibility to piping; medium to high compressibility; fair to poor compaction.	Somewhat poorly drained; moderate permeability; flooding.	High available water capacity; moderate intake rate; flooding.	(1)	Somewhat poorly drained; flooding; seepage; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture; flooding.
Medium to low strength, permeability, and susceptibility to piping; medium to high compressibility; fair compaction.	Well drained	Medium available water capacity; moderate intake rate.	(1)	Erodible on slopes	Fair trafficability; clayey subsoil; moderate soil moisture.
Medium to low strength, compressibility, and permeability; medium to high susceptibility to piping; fair compaction.	Poorly drained; slow permeability; flooding.	Medium available water capacity; moderate intake rate; flooding.	(1)	Poorly drained; flooding; seepage; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture; flooding.
Medium to low strength, compressibility, permeability, and susceptibility to piping; good compaction.	Well drained	Medium available water capacity; moderate intake rate.	(2)	(2)	Good trafficability; moderate soil moisture.
Medium to low strength, permeability, and susceptibility to piping; high compressibility; poor compaction.	Somewhat poorly drained; slow permeability; flooding.	Medium available water capacity; slow intake rate; flooding.	(1)	Somewhat poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; plastic, clayey subsoil; high soil moisture; flooding.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
Pactolus: Pa	Good	Good	Poor: sandy	Seasonal high water table; rapid permeability; seepage.
Pamunkey: PmA, PmB, PmD, PnC3.	Fair: silty	Poor: sand and gravel in spots below a depth of about 4 feet.	Fair in the upper 36 inches.	Moderate permeability; seepage.
Pinkston: PoE	Poor: rock at a depth of 2 to 3 feet.	Unsuited	Poor: hard to reclaim borrow area.	Moderately rapid permeability; seepage; rock at a depth of 2 to 3 feet.
Portsmouth: Pr	Poor: very poorly drained.	Unsuited	Poor: very poorly drained; hard to reclaim borrow area.	Seasonal high water table; moderate permeability; seepage.
Pouncey: Ps	Poor: clayey subsoil; poorly drained; rock at a depth of 1½ to 3½ feet.	Unsuited	Poor: thin surface layer; poorly drained.	Seasonal high water table; very slow permeability; rock at a depth of 1½ to 3½ feet.
Rains: Ra	Poor: poorly drained	Unsuited	Poor: hard to reclaim borrow area; poorly drained.	Seasonal high water table; moderate permeability.
Riverview: Re	Fair: silty	Unsuited	Good in the upper 48 inches.	Moderate permeability; seepage.
Roanoke: Ro	Poor: plastic, clayey subsoil; high shrink-swell potential; poorly drained.	Unsuited	Poor: thin surface layer; poorly drained.	Seasonal high water table; slow permeability.
Rumford: RrC	Good	Poor: sand and gravel in some areas below a depth of about 3 feet.	Poor: sandy	Rapid permeability; seepage.

interpretations—Continued

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Medium strength; low compressibility; medium to high permeability and susceptibility to piping; fair compaction.	Moderately well drained; rapid permeability; flooding.	Low available water capacity; rapid intake rate; flooding.	(1)	Moderately well drained; low available water capacity; flooding; siltation of channels.	Good trafficability; seasonal high water table; moderate soil moisture; flooding.
Medium to low strength, compressibility, permeability, and susceptibility to piping; good compaction.	Well drained	(2)	(2)	(2)	Fair trafficability, moderate soil moisture.
Medium strength, low compressibility and permeability; medium susceptibility to piping; fair to good compaction.	Somewhat excessively drained to excessively drained.	(1)	Moderately rapid permeability; rock at a depth of 2 to 3 feet; slope.	(1)	Good trafficability, low soil moisture.
Medium to low strength, compressibility, and permeability; medium to high susceptibility to piping; good to fair compaction.	Very poorly drained; moderate permeability; flooding.	Medium available water capacity; moderate intake rate; flooding.	(1)	Very poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture flooding.
Medium to low strength, permeability, and susceptibility to piping; high compressibility; poor to fair compaction.	Poorly drained, very slow permeability; rock at a depth of 1½ to 3½ feet; flooding.	Low available water capacity; slow intake rate; rock at a depth of 1½ to 3½ feet; flooding.	(1)	Poorly drained; low available water capacity; rock at a depth of 1½ to 3½ feet; flooding; siltation of channels.	Poor trafficability; seasonal high water table; clayey subsoil; high soil moisture; flooding.
Medium to low strength, permeability, and susceptibility to piping; medium to high compressibility; fair to poor compaction.	Poorly drained; moderate permeability; flooding.	High available water capacity; moderate intake rate; flooding.	(1)	Poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; high soil moisture; flooding.
Medium to low strength and permeability; medium compressibility; high susceptibility to piping; fair to poor compaction.	Well drained; flooding.	High available water capacity; moderate intake rate; flooding.	(1)	Flooding; siltation of channels.	Poor trafficability; high soil moisture; flooding.
Low to medium strength, permeability, and susceptibility to piping; high compressibility; poor compaction.	Poorly drained; slow permeability; flooding.	Medium available water capacity; slow intake rate; flooding.	(1)	Poorly drained; flooding; siltation of channels.	Poor trafficability; seasonal high water table; plastic, clayey subsoil; high soil moisture; flooding.
Low to medium strength, compressibility, and permeability; medium to high susceptibility to piping; fair to good compaction.	Somewhat excessively drained.	Low available water capacity; rapid intake rate.	Rapid permeability; erodible; siltation of channels.	Low available water capacity; erodible; siltation of channels.	Good trafficability; low plasticity; moderate soil moisture.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Road fill	Sand and gravel	Topsoil	Pond reservoir areas
Ruston: RuA, RuB, RuC2	Fair: silty	Unsuited	Fair in the upper 36 inches.	Moderate permeability; seepage.
Sassafras: SsA, SsB	Fair: silty	Poor: sand and gravel in spots below a depth of about 4 feet.	Good in the upper 30 inches.	Moderate permeability; seepage.
State: StA, StB, StC2, SvB.	Fair: silty	Unsuited	Fair in the upper 30 inches.	Moderate permeability; seepage.
Tetotum: Td, Te	Fair: silty	Unsuited	Fair in the upper 36 inches.	Seasonal high water table; moderate permeability; seepage.
Toccoa: To	Fair: silty	Unsuited	Fair in the upper 36 inches.	Moderate rapid permeability; seepage.
Turbeville: TuA, TuB, TuC2, TvB, TvC.	Poor: clayey suboil	Unsuited	Poor: hard to reclaim borrow area.	Moderate permeability
Wedowee: WeB, WeD	Fair: clayey, moderate shrink-swell potential.	Unsuited	Poor: hard to reclaim borrow area.	Moderate permeability; seepage.

[1] Generally favorable features.

interpretations—Continued

Soil features affecting—Continued					
Embankments and dikes	Drainage for crops and pasture	Irrigation	Terraces or diversions	Grassed waterways	Suitability for winter grading
Medium to low strength, compressibility, permeability, and susceptibility to piping; good to fair compaction.	Well drained	(2)	(2)	(2)	Good trafficability; moderate soil moisture.
Medium strength, compressibility, permeability, and susceptibility to piping; fair to good compaction.	Well drained	(2)	(2)	(2)	Good trafficability; moderate soil moisture.
Medium to low strength; compressibility, permeability, and susceptibility to piping; good to fair compaction.	Well drained	(2)	(2)	(2)	Fair trafficability; moderate soil moisture.
Medium to low strength, compressibility, permeability, and susceptibility to piping; good to fair compaction.	Moderately well drained; moderate permeability.	Medium available water capacity; seasonal high water table; moderate intake rate.	(1)	Moderately well drained.	Poor trafficability; seasonal high water table; high soil moisture.
Medium to low strength, compressibility, and permeability; high susceptibility to piping; fair compaction.	Well drained; flooding.	Medium available water capacity; moderate intake rate; flooding	(1)	Flooding; siltation of channels.	Fair trafficability; high soil moisture; flooding.
Medium to low strength, permeability, and susceptibility to piping; high compressibility; poor to fair compaction.	Well drained	(2)	(2)	(2)	Poor trafficability; clayey subsoil; high soil moisture.
Medium to low strength, permeability, and susceptibility to piping; medium to high compressibility; fair compaction.	Well drained	High available water capacity; moderate intake rate.	(2)	Erodible on slopes	Fair trafficability; moderate soil moisture.

[2] Practice not applicable on this soil.

TABLE 7.—*Engineering*

[Tests made by the Bureau of Public Roads (BPR) in accordance with standard

Soil name and location	Parent material	BPR report number SO–	Depth	Moisture density [1]	
				Maximum dry density	Optimum moisture
			Inches	*Pounds per cubic foot*	*Percent*
Angie loam:					
0.75 mile NW. of Eaves Lake Road and Mill Road (thicker than modal).	Alluvium.	51388	0–8	104	17
		51389	12–38	103	21
		51390	38–114	103	21
Atlee very fine sandy loam:					
0.4 mile S. of Fort Lee at the intersection of Charles City Road and the Chesapeake and Ohio Railroad (modal).	Coastal Plain sediment.	51391	4–12	114	13
		51392	22–33	113	15
		51393	33–54	106	20
		51394	66–102	107	19
Bertie fine sandy loam:					
1.25 miles NE. of Meadow Road, 1 mile S. of Southern Railroad (modal).	Alluvium and Coastal Plain sediment.	51424	9–19	117	11
		51425	19–36	116	14
		51426	36–59	114	15
Bourne fine sandy loam:					
1 mile E. of Shady Grove Church, 0.25 mile S. of Shady Grove Road (modal).	Coastal Plain sediment.	51398	2–13	124	10
		51399	18–31	129	9
		51400	31–44	110	17
		51401	44–53	109	17
Colfax fine sandy loam:					
In West Broad Street Gardens at Bunche Street and Hawkins Road (modal).	Granite and gneiss.	51405	3–6	122	8
		51406	6–30	126	10
		51407	30–48	124	11
		51408	48–54	132	8
Duplin very fine sandy loam:					
0.9 mile W. of Meadow Road, 100 feet N. of Interstate Highway 64 (modal).	Coastal Plain sediment.	51409	1–7	117	12
		51410	19–43	107	20
		51411	43–110	104	21
Helena fine sandy loam:					
0.25 mile NE. of Short Pump fire tower and 100 feet S. of Interstate Highway 64 (modal).	Granite, gneiss, and schist.	51421	0–10	121	11
		51422	10–28	101	19
Kinston silt loam:					
1 mile NE. of Meadow Road, 0.7 mile N. of Southern Railroad (modal).	Alluvium.	51402	2–6	92	25
		51403	6–40	109	16
		51404	40–74	109	17
Lenoir silt loam:					
0.5 mile W. of Eaves Lake and Mill Road, and 0.3 mile E. of the James River (thicker than modal).	Alluvium.	51395	3–7	106	19
		51396	15–55	102	22
		51397	55–112	105	21
Lynchburg very fine sandy loam:					
0.9 mile W. of Fair Oaks, 200 feet E. of Oak Street, 100 feet S. of Southern Railroad (modal).	Coastal plain sediment.	51412	4–14	123	11
		51413	25–47	114	15
		51414	47–104	114	15
Myatt fine sandy loam:					
0.6 mile SE. of Creighton Road, 0.5 mile W. of Chickahominy River, 0.10 mile E. of end of farm road (modal).	Alluvium.	51415	3–15	118	11
		51416	15–37	118	13
		51417	37–67	119	13
Turbeville fine sandy loam:					
0.1 mile E. of Roslyn Episcopal Estate, 0.25 mile W. of Westham Creek, and 0.1 mile S. of River Road (modal).	Alluvium.	51418	0–7	121	10
		51419	12–56	105	20
		51420	56–82	102	22

[1] Based on AASHO Designation T–99–57, Method A (*2*).

[2] Mechanical analyses according to AASHO Designation T–88–57 (*2*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis date in this table are not used in naming USDA textural classes for soil.

test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—					AASHO [3]	Unified [4]
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
							Percent			
100	100	99	93	81	24	11	26	3	A–4(8)	ML
100	100	100	96	91	54	43	50	22	A–7–6(15)	MH–CH
100	100	100	94	90	55	43	51	23	A–7–6(16)	MH–CH
100	100	100	90	71	25	15	20	2	A–4(8)	ML
100	100	100	83	70	38	29	34	15	A–6(10)	CL
100	100	100	84	74	44	37	47	20	A–7–6(14)	ML–CL
100	100	99	79	64	39	33	34	19	A–6(13)	CL
100	100	99	42	28	10	6	16	[5]	A–4(2)	SM
100	100	99	40	30	19	16	24	3	A–4(1)	SM
100	100	99	29	20	13	11	21	[5]	A–2–4(0)	SM
100	100	79	45	39	14	7	16	2	A–4(2)	SM
100	100	73	41	35	20	15	22	7	A–4(2)	SM–SC
100	100	89	67	51	39	34	45	15	A–7–5(10)	ML
100	100	71	47	42	34	32	46	16	A–7–5(5)	SM
100	99	87	39	30	9	4	15	[5]	A–4(1)	SM
[6] 99	99	88	49	30	16	11	18	5	A–4(3)	SM–SC
[6] 99	98	88	48	32	19	15	24	10	A–4(3)	SC
[6] 98	97	82	35	11	6	4	12	[5]	A–2–4(0)	SM
100	100	98	60	47	16	9	16	[5]	A–4(6)	ML
100	100	94	72	60	40	33	50	22	A–7–6(14)	MH–CH
100	100	97	88	77	48	37	50	21	A–7–6(15)	MH–CH
[6] 96	96	65	45	7	3	2	20	2	A–4(2)	SM
100	100	80	72	68	51	42	62	31	A–7–5(20)	MH–CH
100	100	97	78	49	23	17	47	16	A–7–5(12)	ML
100	100	97	69	51	30	24	30	13	A–6(8)	CL
100	100	95	65	52	35	29	40	20	A–6(10)	CL
100	100	96	91	76	27	15	34	9	A–4(8)	ML–CL
100	100	100	97	90	55	41	51	24	A–7–6(16)	MH–CH
100	100	100	94	85	54	40	49	22	A–7–6(15)	ML–CL
100	100	98	66	54	23	14	18	3	A–4(7)	ML
100	100	98	69	56	33	25	34	15	A–6(9)	CL
100	100	97	64	47	35	30	44	24	A–7–6(12)	CL
100	100	95	49	33	10	7	16	[5]	A–4(3)	SM
100	100	99	59	43	27	22	28	12	A–6(6)	CL
100	100	99	46	33	18	16	21	[5]	A–4(3)	SM
100	100	82	48	37	11	5	17	[5]	A–4(3)	SM
100	100	89	70	65	52	49	51	19	A–7–5(13)	MH
100	100	88	67	61	48	45	53	20	A–7–5(13)	MH

[3] Based on AASHO Designation M–145–49 (*2*).

[4] Based on the Unified Soil Classification System, (*3*, *8*). SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. Examples of borderline classification obtained by this use are MH–CH, ML–CL, and SM–SC.

[5] Nonplastic.

[6] The amount of material passing the ⅜ inch sieve was 100 percent.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Ratings of soils for corrosivity for concrete are based mainly on soil texture and acidity. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists working with the soils of Henrico County.

Following are explanations of the columns in table 6.

Road fill is soil material used in road embankments. Suitability as a source of road fill depends on (1) the predicted behavior of the soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material from borrow areas.

Sand and gravel are used in many kinds of construction. The ratings in table 6 provide guidance as to probable sources. A soil rates as a *good* or *fair* source of sand or gravel generally has a layer of at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings neither take into account thickness of overburden, location of the water table, or other factors that affect excavation of the materials, nor do they indicate quality of the deposit.

Topsoil is used for topdressing in an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the soil material, or the response of plants to fertilizer; and the absence of substances toxic to plants. The texture of the soil material and its content of stone fragments affect the suitability of the topsoil used for topdressing. Damage that results at the area from which topsoil is taken is also considered.

Pond reservoir areas are areas where water is impounded. Soil features considered are permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments and dikes require compacted soil material resistant to seepage and piping. They also require favorable stability, shrink-swell potential, shear strength, and compactibility. The presence of stones or organic material in a soil are unfavorable factors.

Drainage for crops and pasture depends on those features and qualities of the soil that affect the installation of a drainage system and the performance of surface or subsurface drains. These are slope, depth to the water table, permeability, depth to rock, availability of suitable outlets, texture, structure, stability in ditchbanks, and susceptibility to stream overflow.

Irrigation is affected by the rate of water intake, permeability, natural drainage, available water capacity, susceptibility to water erosion or soil blowing, depth to the water table, texture, susceptibility to flooding, slope, the presence of coarse fragments, depth of the root zone, and depth to bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. They are affected by slope, depth to bedrock or other unfavorable material, presence of stones, permeability, soil stability, and susceptibility to water erosion and soil blowing.

Soil features that affect waterway layout and construction are texture, depth, and erodibility of the soil material; presence of stones or rock outcrop; and the steepness of slopes. Factors affecting the establishment and maintenance of vegetation are seepage, natural soil drainage, available water capacity, and susceptibility to siltation.

Suitability of soils for winter grading depends on the ease with which soils can be moved and traversed by conventional construction equipment during cold weather. Slope, texture, depth of water table, susceptibility to formation of large frozen clods, and the kind and amount of clay affect a soil for winter grading.

Engineering test data

Table 7 gives the results of laboratory tests of samples of soils from 12 series in Henrico County. The tests were performed by the Virginia Department of Highways under a cooperative agreement with the U.S. Department of Commerce, Bureau of Public Roads. They were done in accordance with standard test procedures of the American Association of State Highway Officials to help evaluate the soils for engineering purposes. The engineering soil classifications given in table 7 are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. Mechanical analyses were made by the combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at a successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After then, density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density (*5*).

The tests to determine liquid limit and plasticity index measure the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid state to a plastic state. As the moisture content further increases, the material changes from a plastic state to a liquid state. The *plastic limit* is reached when the soil material contains enough moisture to pass from a semisolid to a plastic state. The *liquid limit* is reached when the soil material contains enough moisture to pass from a plastic state to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

Town and Country Planning

This section was prepared chiefly for planners, developers, landscape architects, builders, zoning officials, realtors, private and potential landowners, and others interested in use of the soils in Henrico County for nonfarm uses. The county is in the metropolitan area of the city of Richmond, and its population is increasing as the urban area steadily expands into rural area. In particular, the demand for outdoor recreational facilities is increasing.

Soil and water losses from land areas undergoing urbanization are often excessive (fig. 8). Construction of streets, roads, shopping centers, and large buildings, land shaping, and installation of water and sewage lines remove the vegetation from the soils and leaves them exposed to erosion for long periods of time. Increased runoff and downstream siltation extend the damage far beyond the construction area. Soil and water losses in these areas can be reduced by adequate management practices during construction (fig. 9).

Contractors and developers should expose the smallest practical area of land at any one time and keep the exposure to the shortest practical time. They should use either temporary vegetation or mulching or a combination of both if needed and use sediment basins to

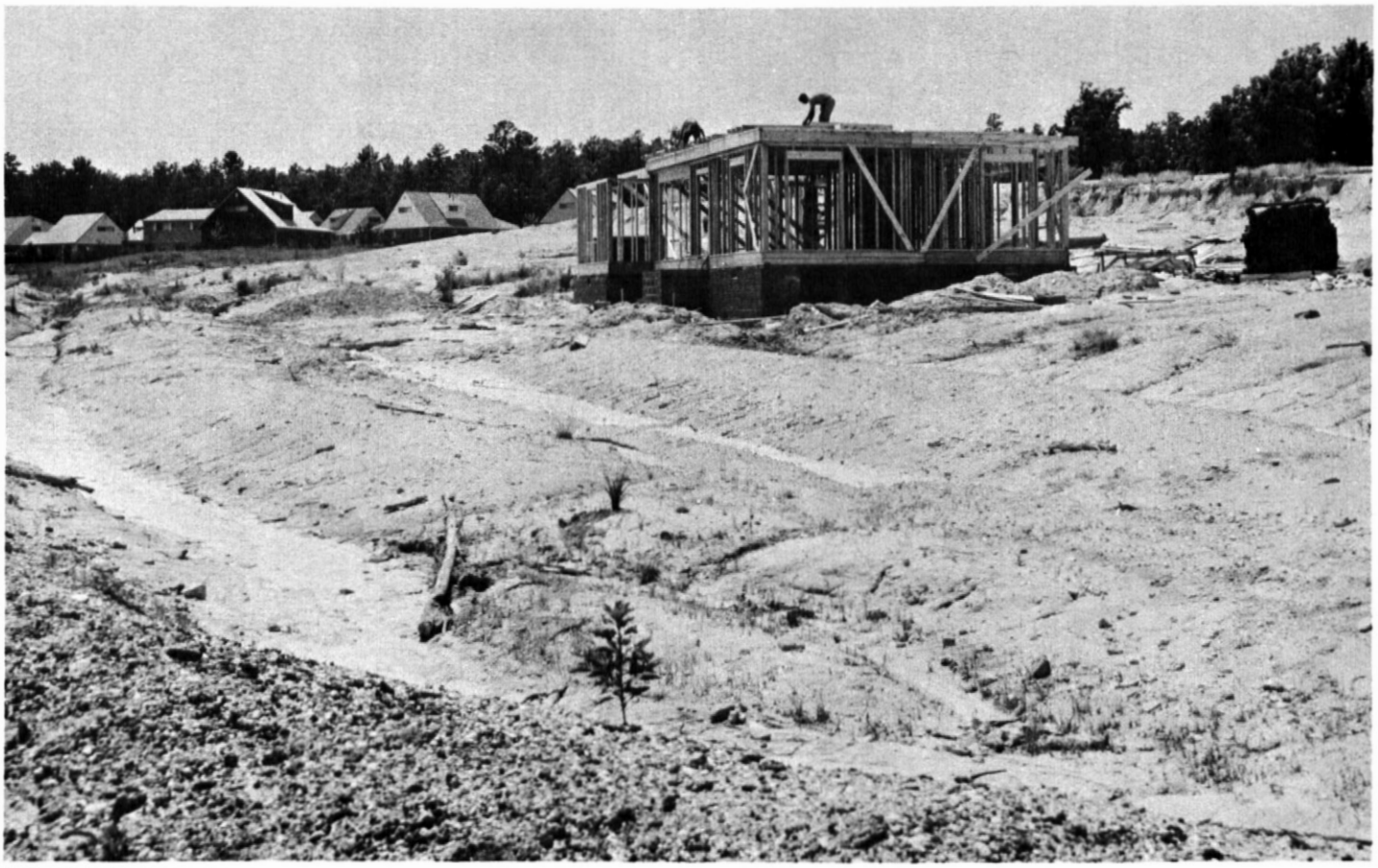

Figure 8.—**Area of an unprotected Appling fine sandy loam eroding during construction.**

control siltation. They should install measures to control increased runoff and to retain and protect natural vegetation.

Table 8 shows the estimated degree and kinds of limitations of the soils of the county for septic tank absorption fields; sewage lagoons; shallow excavations; dwellings with and without basements; sanitary landfills; local roads and streets; lawns, gardens, and landscaping; playgrounds; camp areas; and picnic areas. The degree of limitation is indicated by the ratings *slight, moderate,* and *severe.* A *slight* limitation means that soil properties are generally favorable and limitations can easily be overcome. A *moderate* limitation can be overcome or modified by planning, design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, or intense maintenance or a combination of these is required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material at a depth of 18 inches and extending to a depth of 6 feet is evaluated on the basis of those soil properties that affect both the absorption of effluent and the construction and operation of the system. Absorption is affected by permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects the difficulty of layout and construction as well as the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs (*9*).

Sewage lagoons are shallow impoundments that are constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the impoundment is protected from flooding. Permeability, content of organic matter, and slope are soil properties that affect the impoundment. Depth to bedrock and the condition of the bedrock become important factors if the impoundment floor needs to be leveled. Engineering properties of the embankment material, as interpreted by the Unified Soil Classification, as well as the quantity of stones that influence the ease of excavation and compaction of the embankment material affect the embankment.

Figure 9.—**Erosion of freshly graded Norfolk fine sandy loam.**

Shallow excavations are those that require digging or trenching to a depth of 6 feet or less. Examples of shallow excavations include excavations for pipelines, sewer lines, telephone and power transmission lines, basements, open ditches, and cemeteries. Favorable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or from a seasonal high water table.

Dwellings, as rated in table 8, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings relate to capacity of the soil material to support load, to resist settlement under load and to be easily excavated. Soil properties that affect capacity to support load are moisture content, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. These properties that affect excavation are moisture content, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfills are places where garbage, trash, and other ordinary household refuse is dumped and covered with a thin layer of soil material each day. Some soil properties that affect suitability for landfill are ease of excavation and permeability, which determines whether pollutants can enter ground water. The most favorable soils have moderately slow permeability. Other soil properties that affect suitability for landfill include depth to hard rock, depth to a seasonal high water table, dominant texture as it affects workability, presence of stones or rock outcrops, and the hazard of flooding. Unless otherwise stated, the ratings in table 8 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches exceed that depth. For some soils, reliable predictions can be made to a depth of 10 or 15 feet; however, an onsite investigation is necessary before a site is selected.

Local roads and streets, as rated in table 8, have an all-weather surface which is expected to maintain vehicular traffic throughout the year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and to provide for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of available cut and fill material. The AASHO and Unified classifications of soils, as well as the shrink-swell potential, indicate traffic-supporting capacity of the soil. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Among the soil limitations for lawns, gardens, and landscaping are natural drainage, degree of slope, depth to bedrock or other restrictive layer, texture of the surface soil, stoniness, outcrops of rock, and the hazard of flooding. The soils must have moderate trafficability. Soil at the site is used, and no fill material or topsoil is imported. Traps or roughs are not considered in the ratings for landscaping of golf fairways.

Lawns, gardens, and landscaping in subdivisions or other built-up areas often encounter special problems. Soil materials excavated for foundations and basements are usually spread over the surrounding area. This often results in a loamy to clayey surface layer. In addition, the surface layer is often compacted by machinery and other traffic during construction. Lawns and recreation areas are subject to a variety of uses that compact the surface layer and wear away the grass cover.

Preparation of a good seedbed, seeding of adapted grasses, application of lime and fertilizer, necessary watering, and regulation of use all help alleviate these problems.

Playgrounds and athletic fields are intensively used. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Camp areas for tents and small trailers are subject to heavy foot traffic and limited vehicular traffic. Other than shaping and leveling for tent and parking areas, little site preparation is needed. The best soils have mild slopes, good drainage, no rocks or coarse fragments on the surface, no flooding during the periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic grounds are not subject to heavy foot traffic, but most vehicles are confined to access roads. The best soils have a surface that is firm when wet but not dusty when dry, no flooding during the period of use, and few slopes or stones that increase the cost of site preparation.

Formation, Morphology, and Classification of the Soils

This section has three main parts. In the first part factors of soil formation and their effect on the soils in Henrico County are discussed. The second part is a brief explanation of the morphology of the soils. In the third part the classification of the soils is explained, and the soil series are placed in the higher categories of soil classification.

Formation of the Soils

Soil is the collection of natural bodies, differentiated into horizons of mineral and organic constituents, usually unconsolidated and of variable depth. It differs from the parent material below in morphology, physical and chemical properties, and biological characteristics. The environmental factors mainly responsible for the formation of soils are parent material, relief, climate, living organisms, and time. Parent material is the mass, relief and time are the conditions that affect the mass, and climate and living organisms supply the

TABLE 8.—*Estimated degree and kinds of limitations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such other series that appear in the first column of this table. Aquents, loamy (AQ), Fluvaquents (FL), Hydraquents (HS), Ochrepts and Udults in this table because their properties are too variable to estimate]

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
Abell: AbB	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Altavista: AfA, AfB	Severe: seasonal high water table; flooding in places.	Severe: moderate permeability; seepage.	Moderate: [2] moderately well drained.	Moderate: [2] moderately well drained.	Slight: [2]
Angie: AgA	Severe: moderately well drained; slow permeability.	Slight: [2]	Severe: clayey subsoil.	Moderate: [2] moderately well drained; moderate shrink-swell potential.	Moderate: [2] moderate shrink-swell potential.
AgB, AgB2	Severe: moderately well drained; slow permeability.	Moderate: [2] slope	Severe: clayey subsoil.	Moderate: [2] moderately well drained; moderate shrink-swell potential.	Moderate: [2] moderate shrink-swell potential.
AgC2	Severe: moderately well drained; slow permeability.	Severe: slope	Severe: clayey subsoil.	Moderate: [2] moderately well drained; moderate shrink-swell potential; slope.	Moderate: [2] moderate shrink-swell potential; slope.
AgE2	Severe: moderately well drained; slow permeability; slope.	Severe: slope	Severe: clayey subsoil; slope.	Severe: slope	Severe: slope
Angie variant: Ak	Severe: moderately well drained; slow permeability.	Moderate: [2] concretions in lower part of the subsoil; seepage.	Severe: concretions in lower part of the subsoil.	Moderate: [2] moderately well drained; moderate shrink-swell potential.	Moderate: [2] moderate shrink-swell potential.
Appling: AmB	Moderate: [4] moderate permeability; slope.	Moderate: [4] moderate permeability; slope.	Moderate: clayey subsoil.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
AmC2	Moderate: [4] moderate permeability; slope.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
AmE2	Severe: [4] slope	Severe: [4] slope	Severe: slope	Severe: slope	Severe: slope
AoC3	Moderate: [4] moderate permeability; slope.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slopes.
Ashlar: AsD	Severe: rock at a depth of 2 to 3½ feet.	Severe: moderately rapid permeability; rock at a depth of 2 to 3½ feet; slope.	Severe: rock at a depth of 2 to 3½ feet.	Severe: rock at a depth of 2 to 3½ feet.	Moderate: rock at a depth of 2 to 3½ feet; slope.

See footnotes at end of table.

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mapping units have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to (OUD, OUF), Orthents-Udults-Mine pits (OW), Psamments, gently sloping (PTB), Udorthents (UD, UE), and Urban land (UR) are not included

Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Severe: seasonal high water table; flooding.	Moderate: flooding, silty.	Slight [2]	Moderate: [2] slope	Slight [2]	Slight.[3]
Severe: seasonal high water table; seepage.	Moderate: [2] silty	Slight [3]	Moderate: moderately well drained; slope in AFB	Slight [2]	Slight.[3]
Severe: seasonal high water table; clayey subsoil.	Severe: clayey subsoil.	Slight [3]	Moderate: moderately well drained.	Slight [2]	Slight.[3]
Severe: seasonal high water table; clayey subsoil.	Severe: clayey subsoil.	Slight [3]	Moderate: moderately well drained; slope.	Slight [2]	Slight.[3]
Severe: seasonal high water table: clayey subsoil.	Severe: clayey subsoil.	Moderate: slope	Severe: slope	Moderate: [2] slope	Moderate: slope.
Severe: seasonal high water table; clayey subsoil.	Severe: clayey subsoil; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: seasonal high water table.	Moderate: [2] silty	Slight [3]	Moderate: moderately well drained.	Slight [2]	Slight.[3]
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Moderate: slope	Slight	Slight.
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Moderate: [4] clayey subsoil; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Moderate: surface layer of clay loam; slope.	Severe: slope	Moderate: surface layer of clay loam; slope.	Moderate: surface layer of clay loam; slope.
Severe: rock at a depth of 2 to 3½ feet.	Moderate: rock at a depth of 2 to 3½ feet; slope.	Moderate: rock at a depth of 2 to 3½ feet; surface layer of gravelly sandy loam; slope.	Severe: slope	Moderate: slope	Moderate: slope.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
Ashlar (con.): AsE	Severe: rock at a depth of 2 to 3½ feet; slope.	Severe: moderately rapid permeability; rock at a depth of 2 to 3½ feet; slope.	Severe: rock at a depth of 2 to 3½ feet; slope.	Severe: rock at a depth of 2 to 3½ feet; slope.	Severe: slope
Atlee: At	Severe: [4] moderately well drained; moderately slow permeability; fragipan.	Slight [4]	Moderate: moderately well drained; fragipan.	Moderate: moderately well drained; fragipan.	Slight
Bertie: Be	Severe: [4] somewhat poorly drained; moderately slow permeability; flooding.	Severe: [4] seasonal high water table; flooding.	Severe: somewhat poorly drained flooding.	Severe: somewhat poorly drained; seasonal high water table; flooding.	Severe: seasonal high water table; flooding.
Bourne: BoA, BoB	Severe: [4] moderately well drained; slow to very slow permeability; fragipan.	Severe: [4] seasonal high water table; fragipan; seepage.	Severe: seasonal high water table; fragipan.	Severe: seasonal high water table; fragipan.	Severe: seasonal high water table; fragipan.
BoC	Severe: [4] moderately well drained; slow to very slow permeability; fragipan.	Severe: [4] seasonal high water table; fragipan; seepage; slope.	Severe: seasonal high water table; fragipan.	Severe: seasonal high water table; fragipan.	Severe: seasonal high water table; fragipan.
Buncombe: Bu	Severe: [4] flooding	Severe: [4] rapid permeability; flooding.	Severe: too sandy; flooding.	Severe: flooding	Severe: flooding
Caroline: CaB2	Severe: [4] moderately slow permeability.	Moderate: [4] slope	Moderate: clayey subsoil.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
CaC2, CaD2	Severe: [4] moderately slow permeability.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
CbC3	Severe: [4] moderately slow permeability.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
*Cecil: CeC2	Moderate: [4] moderate permeability; slope.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
CeD2, CfD3 For the Turbeville part of CfD3, see Turbeville series.	Severe: [4] slope	Severe: [4] slope	Severe: slope	Severe: slope	Severe: slope
Chastain: Cg	Severe: poorly drained; slow permeability; flooding.	Severe: seasonal high water table; flooding.	Severe: poorly drained; clayey subsoil; flooding.	Severe: poorly drained; high shrink-swell potential; flooding.	Severe: poorly drained; high shrink-swell potential; flooding.

See footnotes at end of table.

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Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Severe: rock at a depth of 2 to 3½ feet; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: [4] seasonal high water table; fragipan.	Severe: too silty; fragipan.	Slight	Moderate: moderately well drained; moderately slow permeability.	Moderate: moderately well drained; moderately slow permeability.	Slight.
Severe: [4] seasonal high water table; flooding.	Severe: flooding	Moderate: somewhat poorly drained; flooding.	Moderate: somewhat poorly drained; moderatly slow permeability; flooding.	Severe: flooding	Moderate: somewhat poorly drained; flooding.
Severe: [4] seasonal high water table; fragipan.	Moderate: too silty; fragipan.	Slight	Severe: slow to very slow permeability.	Severe: slow to very slow permeability.	Slight.
Severe: [4] seasonal high water table; fragipan.	Moderate: too silty; fragipan; slope.	Moderate: slope	Severe: slow to very slow permeability.	Severe: slow to very slow permeability.	Slight.
Severe: [4] rapid permeability; flooding.	Severe: flooding	Severe: too sandy; flooding.	Severe too sandy; flooding.	Severe: flooding	Moderate: too sandy; flooding.
Severe: [4] clayey subsoil.	Severe: clayey subsoil.	Slight	Moderate: moderately slow permeability; slope.	Moderate: moderately slow permeability.	Slight.
Severe: [4] clayey subsoil.	Severe: clayey subsoil.	Moderate: slope	Severe: slope	Moderate: moderately slow permeability; slope.	Moderate: slope.
Severe: [4] clayey subsoil.	Severe: clayey subsoil.	Moderate: surface layer of clay loam; slope.	Severe: slope	Moderate: moderately slow permeability; surface layer of clay loam; slope.	Moderate: surface layer of clay loam; slope.
Moderate: [4] clayey subsoil; slope.	Modrate: clayey subsoil; moderate shrink-swell potential; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Moderate: [4] clayey subsoil; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: poorly drained; clayey subsoil; high shrink-swell potential; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
*Chewacla: Ch, Ck, Cm. For Riverview part of Cm, see Riverview series.	Severe: somewhat poorly drained; flooding.	Severe: seasonal high water table; flooding.	Severe: somewhat poorly drained; flooding.	Severe: somewhat poorly drained; seasonal high water table; flooding.	Severe: seasonal high water table; flooding.
Colfax: CoB	Severe: somewhat poorly drained; slow permeability; fragipan; flooding.	Severe: seasonal high water table; fragipan; seepage.	Severe: somewhat poorly drained; fragipan; flooding.	Severe: somewhat poorly drained; seasonal high water table; fragipan; flooding.	Severe: seasonal high water table; fragipan; flooding.
Coxville: Cp	Severe: poorly drained; moderately slow permeability; flooding.	Slight	Severe: poorly drained; clayey subsoil; flooding.	Severe: poorly drained; high shrink-swell potential; flooding.	Severe: poorly drained; high shrink-swell potential; flooding.
Creedmoor:					
CvB, CvB2	Severe: moderately well drained; very slow permeability.	Moderate: slope	Severe: seasonal high water table; plastic, clayey subsoil.	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.
CvC2	Severe: moderately well drained; very slow permeability.	Severe: slope	Severe: seasonal high water table; plastic, clayey subsoil.	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.
Duplin:					
DuB2	Severe: [4] moderately well drained; slow permeability.	Moderate: [4] slope	Moderate: moderately well drained; clayey subsoil; moderate shrink-swell potential.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
DuC2, DuD2	Severe: [4] moderately well drained; slow permeability.	Severe: [4] slope	Moderate: moderately well drained; clayey subsoil; moderate shrink-swell potential; slope.	Moderate: moderately well drained; moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
DvA	Severe: [4] moderately well drained; slow permeability.	Slight [4]	Moderate: moderately well drained; clayey subsoil; moderate shrink-swell potential.	Moderate: moderately well drained; moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
DwC3	Severe: [4] moderately well drained; slow permeability.	Severe: [4] slope	Moderate: moderately well drained; clayey subsoil; moderate shrink-swell potential; slope.	Moderate: moderately well drained; moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
Faceville:					
FaA	Slight	Moderate: moderate permeability; seepage.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
FaB2	Slight	Moderate: moderate permeability; seepage; slope.	Slight	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
Forestdale: Fo	Severe: poorly drained; very slow permeability; flooding.	Severe: seasonal high water table; flooding.	Severe: poorly drained; clayey subsoil; flooding.	Severe: poorly drained; high shrink-swell potential; flooding.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; flooding.

See footnotes at end of table.

for community and recreational uses of soils—Continued

Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Severe: seasonal high water table; moderate permeability; flooding.	Severe: too silty; flooding.	Severe: flooding	Severe: somewhat poorly drained; flooding.	Severe: flooding	Moderate: somewhat poorly drained; flooding.
Severe: seasonal high water table; rock at a depth of 4 feet or more; fragipan; flooding.	Severe: fragipan; flooding.	Moderate: somewhat poorly drained; fragipan; flooding.	Moderate: somewhat poorly drained; slow permeability flooding.	Severe: flooding	Moderate: somewhat poorly drained.
Severe: poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: poorly drained; clayey subsoil; high shrink-swell potential; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.
Severe: seasonal high water table; plastic, clayey subsoil.	Severe: plastic, clayey subsoil; high shrink-swell potential.	Moderate: surface layer of sandy loam.	Severe: very slow permeability.	Severe: very slow permeability.	Slight.
Severe: seasonal high water table; plastic, clayey subsoil.	Severe: plastic, clayey subsoil; high shrink-swell potential.	Moderate: surface layer of sandy loam; slope.	Severe: very slow permeability; slope.	Severe: very slow permeability.	Moderate: slope.
Severe: [4] seasonal high water table; clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Moderate: slow permeability; slope.	Moderate: slow permeability.	Slight.
Severe: [4] seasonal high water table; clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential; slope.	Moderate: slope	Severe: slope	Moderate: slow permeability; slope.	Moderate: slope.
Severe: [4] seasonal high water table; clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Moderate: slow permeability.	Moderate: slow permeability.	Slight.
Severe: [4] seasonal high water table; clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential; slope.	Moderate: surface layer of clay loam; slope.	Moderate: slow permeability; slope.	Moderate: surface layer of clay loam; slow permeability; slope.	Moderate: surface layer of clay loam; slope.
Slight	Moderate: too silty	Slight	Slight	Slight	Slight.
Slight	Moderate: too silty	Slight	Moderate: slope	Slight	Slight.
Severe: poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: poorly drained; clayey subsoil; high shrink-swell potential; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; very slow permeability; flooding.	Severe: poorly drained; very slow permeability; flooding.	Severe: poorly drained; flooding.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
Helena:					
HeB, HeB2	Severe: moderately well drained; slow permeability.	Moderate: slope	Severe: seasonal high water table; plastic, clayey subsoil.	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.
HeC2	Severe: moderately well drained; slow permeability.	Severe: slope	Severe: seasonal high water table; plastic, clayey subsoil.	Severe: seasonal high water table; high shrink-swell potential.	Severe: high shrink-swell potential.
Kalmia:					
KaA	Severe: flooding	Severe: seepage; flooding.	Severe: flooding	Severe: flooding	Severe: flooding
KaC	Severe: flooding	Severe: seepage; flooding; slope.	Severe: flooding	Severe: flooding	Severe: flooding
Kempsville:					
KeA, KgA	Slight [4]	Severe: [4] seepage	Slight	Slight	Slight
KeB, KgB	Slight [4]	Severe: [4] seepage	Slight	Slight	Slight
KeC2, KgC2	Moderate: [4] slope	Severe: [4] seepage; slope.	Moderate: slope	Moderate: slope	Moderate: slope
KeD2	Severe: [4] slope	Severe: [4] seepage; slope.	Severe: slope	Severe: slope	Severe: slope
KfA, KfB	Severe: [4] flooding	Severe: seepage; flooding.	Severe: [4] flooding	Severe: flooding	Severe: flooding
*Kinston: Km, Kn For Mantachie part of Kn, see Mantachie series.	Severe: poorly drained; flooding.	Severe: seasonal high water table; seepage; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; seasonal high water table; flooding.
Lenoir: Le	Severe: somewhat poorly drained; slow permeability; flooding.	Severe: flooding	Severe: somewhat poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: somewhat poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: seasonal high water table; clayey subsoil; flooding.
Lynchburg: Ly	Severe: somewhat poorly drained.	Severe: seasonal high water table; seepage.	Severe: somewhat poorly drained; seasonal high water table.	Severe: somewhat poorly drained; seasonal high water table.	Severe: seasonal high water table.
*Mantachie: Mc For Chastain part, see Chastain series.	Severe: somewhat poorly drained; flooding.	Severe: seasonal high water table; seepage; flooding.	Severe: somewhat poorly drained; seasonal high water table; flooding.	Severe: somewhat poorly drained; seasonal high water table; flooding.	Severe: seasonal high water table; flooding.
Mayodan: MdB2	Moderate: [4] moderate permeability; rock at a depth of 4 feet or more.	Moderate: [4] moderate permeability; rock at a depth of 4 feet or more; slope.	Moderate: clayey subsoil; rock at a depth of 4 feet or more.	Moderate: clayey subsoil; moderate shrink-swell potential; rock at a depth of 4 feet or more.	Moderate: clayey subsoil; moderate shrink-swell potential.
Myatt: My	Severe: poorly drained; slow permeability; flooding.	Severe: seasonal high water table; seepage; flooding.	Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; seasonal high water table; flooding.
Norfolk:					
NoA	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Slight	Slight

See footnotes at end of table.

for community and recreational uses of soils—Continued

Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Severe: seasonal high water table; plastic, clayey subsoil.	Severe: plastic, clayey subsoil; high shrink-swell potential.	Slight	Moderate: slow permeability.	Moderate: slow permeability.	Slight.
Severe: seasonal high water table; plastic, clayey subsoil.	Severe: plastic, clayey subsoil; high shrink-swell potential.	Moderate: slope	Moderate: slow permeability; slope.	Moderate: slow permeability; slope.	Moderate; slope.
Severe: seepage; flooding.	Severe: flooding	Severe: flooding	Moderate: flooding	Severe: flooding	Moderate: flooding.
Severe: seepage; flooding.	Severe: flooding	Severe: flooding	Severe: slope	Severe: flooding	Moderate: flooding.
Slight [4]	Moderate: too silty	Slight	Slight	Slight	Slight.
Slight [4]	Moderate: too silty	Slight	Moderate: slope	Slight	Slight.
Slight [4]	Moderate: too silty; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Moderate: [4] slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: [4] flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding.
Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.
Severe: seasonal high water table; clayey subsoil; flooding.	Severe: seasonal high water table; clayey subsoil; flooding.	Severe: flooding	Severe: somewhat poorly drained; flooding.	Severe: somewhat poorly drained; flooding.	Moderate: somewhat poorly drained; flooding.
Severe: seasonal high water table.	Severe: seasonal high water table.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained.	Moderate: somewhat poorly drained.
Severe: seasonal high water table; flooding.	Severe: flooding	Severe: flooding	Severe: somewhat poorly drained; flooding.	Severe: somewhat poorly drained; flooding.	Moderate: somewhat poorly drained; flooding.
Severe: [4] clayey subsoil; rock at a depth of 4 feet or more.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Moderate: slope	Slight	Slight.
Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.
Slight	Moderate: too silty	Slight	Slight	Slight	Slight.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
Norfolk (con.):					
NoB	Moderate: moderate permeability.	Moderate: moderate permeability; slope.	Slight	Slight	Slight
NoC	Moderate: moderate permeability; slope.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope
Orange: Ov	Severe: somewhat poorly drained; slow permeability flooding.	Moderate: rock at a depth of 3½ to 5 feet.	Severe: somewhat poorly drained; plastic, clayey subsoil; flooding.	Severe: somewhat poorly drained; seasonal high water table; high shrink-swell potential; flooding.	Severe: high shrink-swell potential; flooding.
Pactolus: Pa	Severe: [4] flooding	Severe: [4] rapid permeability; flooding.	Severe: too sandy; flooding.	Severe: flooding	Severe: flooding
Pamunkey:					
PmA	Slight [4]	Moderate: [4] moderate permeability.	Slight	Slight	Slight
PmB	Slight [4]	Moderate: [4] moderate permeability; slope.	Slight	Slight	Slight
PmD	Moderate: [4] slope	Severe: [4] slope	Moderate: slope	Moderate: slope	Moderate: slope
PnC3	Moderate: [4] slope	Severe: [4] slope	Moderate: slope	Moderate: slope	Moderate: slope
Pinkston: PoE	Severe: [4] rock at a depth of 2 to 3 feet; slope.	Severe: [4] rock at a depth of 2 to 3 feet; slope.	Severe: rock at a depth of 2 to 3 feet; slope.	Severe: rock at a depth of 2 to 3 feet; slope.	Severe: slope
Portsmouth: Pr	Severe: very poorly drained; flooding.	Severe: seasonal high water table; seepage.	Severe: very poorly drained; seasonal high water table; flooding.	Severe: very poorly drained; seasonal high water table; flooding.	Severe: very poorly drained; seasonal high water table; flooding.
Pouncey: Ps	Severe: poorly drained; very slow permeability; rock at a depth of 1½ to 3½ feet; flooding	Severe: seasonal high water table; rock at a depth of 1½ to 3½ feet.	Severe: poorly drained; seasonal high water table; clayey subsoil; rock at a depth of 1½ to 3½ feet; flooding.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; rock at a depth of 1½ to 3½ feet; flooding.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; rock at a depth of 1½ to 3½ feet; flooding.
Rains: Ra	Severe: poorly drained; flooding.	Severe: seasonal high water table; seepage.	Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; seasonal high water table; flooding.	Severe: poorly drained; seasonal high water table; flooding.
Riverview: Re	Severe: [4] flooding	Severe: [4] seepage; flooding.	Severe: flooding	Severe: flooding	Severe: flooding
Roanoke: Ro	Severe: poorly drained; slow permeability; flooding.	Severe: flooding	Severe: poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; flooding.	Severe: poorly drained; seasonal high water table; high shrink-swell potential; flooding.
Rumford: RrC	Slight [4]	Severe: [4] rapid permeability.	Severe: too sandy	Slight	Slight

See footnotes at end of table.

for community and recreational uses of soils—Continued

Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Slight	Moderate: too silty	Slight	Moderate: slope	Slight	Slight.
Slight	Moderate: too silty; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Severe: seasonal high water table; plastic, clayey subsoil; rock at a depth of 3½ to 5 feet; flooding.	Severe: plastic clayey subsoil; high shrink-swell potential; flooding.	Severe: flooding	Severe: somewhat poorly drained; flooding.	Severe: somewhat poorly drained; flooding.	Moderate: somewhat poorly drained; flooding.
Severe: [4] seasonal high water table; too sandy; flooding.	Severe: flooding	Severe: too sandy; flooding.	Severe: flooding	Severe: flooding	Moderate: flooding.
Slight [4]	Moderate: too silty	Slight	Slight	Slight	Slight.
Slight [4]	Moderate: too silty	Slight	Moderate: slope	Slight	Slight.
Slight [4]	Moderate: too silty; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Slight [4]	Moderate: too silty; slope.	Moderate: surface layer of clay loam; slope.	Severe: slope	Moderate: surface layer of clay loam; slope.	Moderate: surface layer of clay loam; slope.
Severe: [4] rock at a depth of 2 to 3 feet.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Severe: very poorly drained; flooding.	Severe: very poorly drained; flooding.	Severe: very poorly drained; flooding.	Severe: very poorly drained; flooding.	Severe: very poorly drained; flooding.	Severe: very poorly drained; flooding.
Severe: poorly drained; clayey subsoil; rock at a depth of 1½ to 3½ feet; flooding.	Severe: poorly drained; clayey subsoil; high shrink-swell potential; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; very slow permeability; flooding.	Severe: poorly drained; very slow permeability; flooding.	Severe: poorly drained.
Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained.
Severe: [4] flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding.
Severe: poorly drained; seasonal high water table; clayey subsoil; flooding.	Severe: poorly drained; clayey subsoil; high shrink-swell potential; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained; flooding.	Severe: poorly drained.
Moderate: [4] too sandy.	Slight	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.

TABLE 8.—*Estimated degree and kinds of limitations*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements [1]	Dwellings without basements [1]
Ruston:					
RuA	Slight [4]	Moderate: [4] moderate permeability.	Slight	Slight	Slight
RuB	Slight [4]	Moderate: [4] moderate permeability; slope.	Slight	Slight	Slight
RuC2	Moderate: [4] slope	Severe: [4] slope	Moderate: slope	Moderate: slope	Moderate: slope
Sassafras:					
SsA	Slight [4]	Moderate: [4] moderate permeability.	Slight	Slight	Slight
SsB	Slight [4]	Moderate: [4] moderate permeability.	Slight	Slight	Slight
State:					
StA	Slight [4]	Moderate: [4] moderate permeability.	Slight	Slight	Slight
StB, SvB	Slight [4]	Moderate: [4] moderate permeability; slope.	Slight	Slight	Slight
StC2	Moderate: [4] slope	Severe: [4] slope	Moderate: slope	Moderate: slope	Moderate: slope
Tetotum:					
Te	Moderate: moderately well drained.	Moderate: moderate permeability.	Moderate: moderately well drained.	Moderate: moderately well drained.	Slight
Td	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Toccoa: To	Severe: [4] flooding	Severe: [4] moderately rapid permeability; flooding.	Severe: flooding	Severe: flooding	Severe: flooding
Turbeville:					
TuA	Moderate: [4] moderate permeability.	Moderate: [4] moderate permeability.	Moderate: clayey subsoil.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
TuB, TvB	Moderate: [4] moderate permeability.	Moderate: [4] moderate permeability; slope.	Moderate: clayey subsoil.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
TuC2, TvC	Moderate: [4] moderate permeability; slope.	Severe: [4] slope	Moderate: clayey subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.
Wedowee:					
WeB	Moderate: [4] moderate permeability.	Moderate: [4] moderate permeability.	Moderate: clay loam subsoil.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential.
WeD	Moderate: [4] moderate permeability; slope.	Severe: [4] slope	Moderate: clay loam subsoil; slope.	Moderate: moderate shrink-swell potential; slope.	Moderate: moderate shrink-swell potential; slope.

[1] Rating applies to small industrial, institutional, or commercial buildings of similar size
[2] Rating is severe if this soil is subject to flooding.

for community and recreational uses of soils—Continued

Sanitary landfills (trench type)	Local roads and streets	Lawns, gardens, and landscaping	Playgrounds	Camp areas	Picnic areas
Slight [4]	Moderate: too silty.	Slight	Slight	Slight	Slight.
Slight [4]	Moderate: too silty.	Slight	Moderate: slope	Slight	Slight.
Slight [4]	Moderate: too silty; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Slight [4]	Moderate: too silty.	Slight	Slight	Slight	Slight.
Slight [4]	Moderate: too silty.	Slight	Moderate: slope	Slight	Slight.
Slight [4]	Moderate: too silty.	Slight	Slight	Slight	Slight.
Slight [4]	Moderate: too silty.	Slight	Moderate: slope	Slight	Slight.
Slight [4]	Moderate: too silty; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Severe: seasonal high water table.	Moderate: too silty.	Slight	Moderate: moderately well drained.	Slight	Slight.
Severe: seasonal high water table; flooding.	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding.
Severe: [4] flooding	Severe: flooding	Moderate: flooding	Severe: flooding	Severe: flooding	Moderate: flooding.
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Slight	Slight	Slight.
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential.	Slight	Moderate: slope	Slight	Slight.
Moderate: [4] clayey subsoil.	Moderate: clayey subsoil; moderate shrink-swell potential; slope.	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope.
Moderate: [4] clay loam subsoil.	Moderate: moderate shrink-swell potential.	Moderate: surface layer of sandy loam.	Moderate: slope	Slight	Slight.
Moderate: [4] clay loam subsoil.	Moderate: moderate shrink-swell potential; slope.	Moderate: surface layer of sandy loam; slope.	Severe: slope	Moderate: slope	Moderate: slope.

[3] Rating is moderate if this soil is subject to flooding.
[4] There may be a hazard of ground water pollution or pollution of nearby streams.

energy that acts upon the mass for the process of soil formation.

The nature of the soil at any given point on the earth is the result of the combined interaction of these soil-forming factors at that point. The relative importance of each soil-forming factor varies from place to place and from time to time. For example, if all other factors are equal, the change in climate from place to place is responsible for different soil development. The same is true for living organisms (including man), parent material, relief, and time. Locally, major and minor variations of any of the soil-forming factors are responsible for the variations in characteristics that are the criteria for soil series differentiation.

Parent material

Parent material is the unconsolidated mass from which a soil developed. It is largely responsible for the chemical and mineral composition of soils. The three broad classes of parent material in Henrico County are residual material, fluviomarine material, and alluvial material (*4*). Residual material has weathered in place from the underlying rocks and forms the basis for the soils of the Piedmont Plateau. Fluviomarine material is transported material that has been reworked by stream and marine action and forms the basis for the soils of the Coastal Plain. Alluvial material is material transported by water and laid down as unconsolidated deposits of clay, silt, sand, and large fragments of rock. It forms the basis for soils on terraces and bottom lands of both the Piedmont Plateau and the Coastal Plain.

Residual material is generally west of the fall line in Henrico County. This material formed primarily from granite, gneiss, schist, and sandstone and shale. Granite, gneiss, and schist weather into parent material that is commonly low in bases and strongly acid.

Fluviomarine material is along and east of the fall line in Henrico County. It consists of transported and reworked sands, silts, and clays that are gravelly to extremely gravelly in places. The material is layered, and texture changes abruptly in many places in vertical or horizontal directions.

Soil formed from fluviomarine material is commonly strongly acid to very strongly acid and low in bases. The texture of the soil reflects the textures of the layers from which it formed. Most of the sands are quartz, which weathers very slowly. Soils formed in sandy layers have slight to moderate development.

Alluvial parent material is of local origin along the smaller streams and drainageways and is of both local and general origin along the Chickahominy and James Rivers. The alluvium has a mixed lithology because of the wide variety of igneous and metamorphic rocks and fluviomarine deposits found in the uplands. Total thickness of the alluvium ranges from several feet along drainageways and small streams to several tens of feet along the Chickahominy and James Rivers. Alluvium along the drainageways and small streams is commonly medium to coarse. Along the Chickahominy and James Rivers, texture varies widely, ranging from fine-textured slackwater deposits to coarse-textured sand and gravel deposits. The soils formed in alluvium are low to moderate in bases and medium acid to strongly acid. The well-drained soils formed in medium-textured to moderately fine textured alluvium along the James River are well suited to farming except for a hazard of flooding.

Relief

Relief, or lay of the land, is largely determined by the underlying geologic formations, the geologic history of the general region, and the effects of dissection by rivers and streams. It affects the formation of soils by causing differences in internal drainage, runoff, and geologic erosion. It can alter the effects of parent material on the development of soils to the extent that several different kinds of soil may form from the same kind of parent material.

Henrico County is in an area of rolling topography, moderately incised by the major drainage patterns. A wide area of river terraces is present along the lower part of the James River from the Richmond area to the southeastern corner of the county. Elevations in the area range from sea level along the James River in the east to a height of about 340 feet in the western part of the county. Generally, the land surface slopes gently to the southeast, at an average rate of 20 feet to the mile.

Henrico County is drained by a number of short streams, which empty either into the Chickahominy River on the north or into the James River on the south. The drainage pattern is, in general, dendritic, but it is irregularly branched. The general fluvial cycle is in a stage of late youth or early maturity.

Soils in most upland areas range from moderately well drained to well drained. They are excessively drained on the steeper slopes. Geologic erosion is active on the steeper slopes; some of these slopes on softer geologic formations are unstable. Accelerated erosion, caused by cultivation and overgrazing, is apparent on many areas.

Slopes of the broader upland ridges range from 0 to about 10 percent. Slopes of the narrower ridges range from about 6 to 15 percent. Side slopes range from 10 to 50 percent. Most slopes are 10 to 25 percent.

Soils on terraces range from somewhat excessively drained to poorly drained. Drainage is commonly related to both the texture and position of the alluvium. Thus, fine-textured slackwater deposits in low positions are often poorly drained, while deep deposits of coarse materials are somewhat excessively drained. Layers of fine-textured materials in the alluvium cause fluctuating water tables and often result in moderately well drained or somewhat poorly drained soils.

Terrace slopes are dominantly 0 to 6 percent. Slopes of the terrace breaks range from 6 to about 50 percent. Streambanks along the larger streams are often very steep and actively eroding.

Climate

Climate affects the physical, chemical, and biological relationships in soils, primarily through the influence of precipitation and temperature. Water dissolves minerals, supports biological activity, and transports mineral and organic residue through the soil solum.

Temperature determines the type of physical, chemical, and biological activity that takes place and the speed at which it acts.

Henrico County has the rather humid, temperate climate typical of most coastal or near-coastal areas of the Middle Atlantic States. Temperature and precipitation data are given in tables in the section "General Nature of the County."

The climate is fairly uniform throughout the county, and there are no significant differences in elevation. Thus, there are no obstructions to the movement of winds, clouds, and rainstorms. Masses of air generally move through the county from a Northwesterly direction, but they are warmed by air that moves in periodically from the south and southwest.

Because precipitation exceeds evapotranspiration, this humid, rather uniform climate has caused the soils to be strongly leached. Most of the soluble material that either was originally present or was released through weathering has been removed. Therefore, most of the soils are strongly acid and generally are low in plant nutrients.

Precipitation is mainly responsible for the subsoil that characterizes most soils in the county. In addition to leaching soluble material, water that percolates through the soil moves clay from the surface layer to a subsoil layer. Except for soils formed in recent alluvium or sand, soils of the county have a subsoil that contains more clay than the surface layer.

Also influenced by climate is the formation of blocky structure in the subsoil of well-developed soils. The development of peds (aggregates) in the subsoil is caused by changes in volume of the soil mass. These changes are primarily the result of alternating wet and dry periods and of alternating freezing and thawing periods.

Weathering of minerals is at a rate proportional to temperature and amount of moisture. Soil weathers more rapidly in tropical regions than in temperate regions and in humid regions than in arid regions. In Henrico County, the soils are commonly relatively low in weatherable minerals. They contain no free carbonates, and most of the bases have been leached out. However, because many of the soils formed in transported parent material that previously had undergone one or more cycles of erosion, these materials may have been highly weathered and leached at the time they were deposited.

Living organisms

Living organisms that affect soil development are micro-organisms, vegetation, animals, and man. Before settlement by man, the native vegetation was most important in the complex of living organisms that affect soil development. The settlers found a dense forest that consisted mainly of hardwoods. Oaks were dominant in most parts of the county. Yellow-poplar, sweetgum, blackgum, holly, hickory, maple, dogwood, loblolly pine, and Virginia pine also were important, but there were probably few pure stands of pine before the county was settled. The fairly pure stands of pine that exist today are generally in areas that were once cleared and cultivated.

Most hardwoods use large amounts of calcium as well as other bases if they are available. Soils that are normally high in bases remain so under a cover of deciduous trees because, in large part, these bases are returned to the soil each year. When the leaves fall and decompose, the bases reenter the soil and are again used by plants.

The soils in Henrico County, however, have never been very high in bases; consequently, they are acid even under a cover of hardwoods. Soils that are strongly acid and low in fertility are better suited to pines than to most hardwoods. Pines do not require large amounts of calcium and other bases. Their needles do little to restore fertility to the soil.

As agriculture developed in the county, man became an important factor in the development of the soils. The clearing of the forests, cultivation in some areas, introduction of new kinds of crops and other plants, and improvements in drainage affected development of the soils and will continue to affect their development in the future.

The most important changes brought about by man include mixing the upper horizons of the soil to form a plow layer, tilling sloping soils, which resulted in accelerated erosion, and liming and fertilizing to change the content of plant nutrients, especially in the upper horizons.

Time

The age of a soil refers to the degree of development of the soil profile rather than to the length of time the soil has undergone the processes that lead to the development of a profile. Some soils, such as Cecil, Duplin, and Norfolk soils, have a well-defined profile. Such soils as Ashlar, Pinkston, and Riverview soils show little or no profile development. The age of any one soil is directly dependent on the action and interaction of the soil-forming factors.

The oldest soils, with regard to degree of development, are those that formed in residuum and that have a subsoil very high in clay content, those that formed in fine-textured alluvium and fluviomarine material, and those that have developed a fragipan. In general, these soils are less sloping, are in stable landscape positions, and have formed in easily weatherable materials. They have a well-developed profile, and they range from moderately well drained to poorly drained.

Soils that formed in sandy fluviomarine and alluvial material and those that formed in recent alluvium are young, with regard to degree of development. The sandy fluviomarine and alluvial material is mostly quartz sand, which weathers very slowly. The soil profile is not well developed. These soils are commonly well drained to somewhat excessively drained.

Soils formed in recent alluvium have been in place for only a relatively short time and show little or no development other than an accumulation of organic matter in the surface layer. Because of the method of deposition, they are commonly in layers, or stratified. Such soils are well drained to poorly drained.

Where soils formed on steeper slopes, geologic erosion removes the soil material over a relatively short period of time, and the soils are not in place long

enough to develop more than a weak horizon differentiation. These soils are well drained to somewhat excessively drained.

Most upland soils in the Piedmont Plateau and Coastal Plain and most of the terrace soils have moderately developed profiles. They are in various stages of development with regard to degree of development and horizon differentiation. They are commonly well drained; however, some soils in low-lying positions are moderately well drained or somewhat poorly drained.

Morphology

Soil morphology in the soils of Henrico County is the result of one or more of the following processes: (1) accumulation of organic matter, (2) leaching of carbonates and salts more soluble than calcium carbonate, (3) chemical weathering of the primary minerals of parent material into silicate clay minerals, (4) translocation of these silicate clay minerals and probably some silt-sized particles from one horizon to another, (5) layering of parent materials, and (6) reduction and transfer of iron.

In the formation of most soils in Henrico County several of these processes have interacted to a varying degree. In some soils only one or two processes have been active, and in others, they have been active only to a slight degree.

Some organic matter has accumulated in all the soils to form an A1 horizon. In many places this horizon has been eroded away or mixed with materials from underlying horizons through cultivation. The content of organic matter varies in the different soils and ranges from low to moderate. Sandy soils, such as Rumford soils, have a weak A1 horizon that contains little organic matter, but such soils as Altavista and Pamunkey soils have moderate A1 horizons with a moderate organic-matter content.

Most of the soils of Henrico County have been very strongly leached of carbonates and salts more soluble than calcium carbonate. Reaction in most soils is strongly acid to very strongly acid. A few soils, such as Pamunkey soils, are medium acid to slightly acid in the B horizon and are not as strongly leached. The Coastal Plain soils are formed in unconsolidated fluviomarine sediments. Leaching of carbonate and other salts probably took place in these sediments even before they were deposited and soils formed from them.

The weathering of primary minerals to silicate clay minerals, largely by the process of hydrolysis, results finally in the production of kaolinitic clays. No complete study of clay minerals has been made in Henrico County, but kaolinite is recognized as the most common and most characteristic clay mineral in the soils of the county. Other clays, such as illite, montmorillonite, and probably halloysite occur in smaller quantities. In many soils, quartz is the dominant mineral in the sand and silt fraction.

The translocation and development in place of silicate clay minerals have contributed strongly to the formation of horizons in the soils of Henrico County. Silicate clays formed in the A horizons have been largely translocated to the B horizons by percolation and have been at least partially immobilized. This process contributes to the formation of a textural B horizon, or one that is higher in clay content than the horizons above it or below it. Silicate clays also develop within a textural B horizon and are often partially or completely immobilized as they are formed. For example, translocation of silicate clays have occurred in Sassafras soils, and both translocation and in-place development of silicate clays have taken place in Turbeville soils.

Layering of parent materials is evident in many soils formed on fluviomarine and alluvial material and in a few soils along the fall line that have formed in a thin fluvial overlay over residual materials. The layering is commonly apparent by a change in the particle size distribution in the soil horizons. Gravel lines are present in some soils, or the gravel content increases or decreases noticeably. In other soils the sand, silt, or clay fraction changes noticeably from horizon to horizon, and the change is not related to the formation and translocation of silicate clays.

Layering influences the formation of soil horizons in several ways. The formation of silicate clays varies proportionately with the amount of weatherable minerals in each layer. A layer high in slowly weatherable quartz sand forms less silicate clay than a layer high in easily weathered silt-sized minerals. Water often moves more slowly between layers of different textures, and this results in a temporary excess of water in the higher layer. As the water slows down minerals carried down by percolation are deposited or precipitated, commonly resulting in the formation of a compact layer that is slowly permeable to very slowly permeable. Some soils have formed a thick clay subsoil developed dense, brittle subsoil layers called fragipans often several feet thick. Helena soils are an example of a soil that has a clay subsoil. Bourne soils are an example of a soil that has a fragipan.

Gleying, the process of chemical reduction and transfer of iron, occurs in soils with impeded drainage. The naturally wet soils of Henrico County have some degree of gleying in one or more horizons. Roanoke and Lenoir soils, for example, have been affected by gleying because of a high water table.

Iron that has been reduced in areas where the soil is poorly aerated generally becomes mobile and may be removed from the soil. Part of the mobile iron moves either within the horizon where it originated or to another horizon. Part of this iron may be segregated and reoxidized to form the red, yellowish-red, strong-brown, and yellowish-brown mottles that are common in some horizons of soils having impeded drainage. The reduction, segregation, and reoxidation of iron has occurred in horizons of Altavista soils.

When silicate clays form from primary material, some iron generally is freed as hydrated oxide. Depending on the degree of hydration, such oxides normally are strongly red. In soils formed in parent material that is highly quartzose and coarse textured, and that lacks sufficient silicate clay minerals to form clayey subsoil horizons, only a small amount of hydrated oxide is required to color the soil material.

Such soils generally have a strong-brown or yellowish-red subsoil. The Ashlar soils have a distinctly colored subsoil horizon.

In most well-developed and freely aerated soils with a clayey B horizon, hydrated iron oxide may color the horizon as strongly as it does in a soil that does not have a clayey B horizon. For example, in Roanoke soils, which have clayey B horizon of low chroma and value, there is little or no visible evidence of free iron oxide. At the other extreme are Turbeville soils, which have red hues, distinctly higher chroma, and generally higher value than Roanoke soils. The clayey B horizon in Turbeville soils is very strongly colored by free iron oxide.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study (*7*), readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however. so that the soils of similar genesis, or mode of origin, are grouped together. In table 9, the soil series of Henrico County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that give broad climatic groupings of soils. The two exceptions to this are Entisols and Histosols, which occur in many different climates.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and dark-red and dark-brown colors associated with basic rocks.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central, or typic, segment of the group, and others called intergrades that have properties of the group as well as one or more properties of another great group, suborder, or order. Subgroups are also made if soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY. Soil families are separated with a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering purposes. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

General Nature of the County

This section provides general information about the history and development; climate; physiography, relief, and drainage; water supply, geology, and industry and farming of Henrico County.

History and Development

In 1611, Henrico County, named for Prince Henry, eldest son of King James I, was established. It was counted among the incorporations of the colony in 1617 and listed as one of the original shires of Virginia in 1634. The population at this time was 419. In 1637 a port was established at the head of navigation of the James River in Henrico County.

From 1610 to 1616, John Rolfe produced the first crop of Virginia tobacco on the Varina Plantation. He brought his bride, Pocohontas, to live at Varina in 1614. Curles Neck Plantation was patented at this time. The county seat was moved to Richmond in 1752 and is there today. The first coal mined in this county was taken from the Richmond Triassic basin in 1750. The Gayton coal mine ceased operations early in the 20th century.

Climate [5]

Henrico County, in the east-central part of Virginia along the fall line, has warm summers, relatively mild winters, and normally adequate rainfall. The county is well inland from the Atlantic Ocean, which has only a

[5] M. H. BAILEY, climatologist for Virginia, National Weather Service, U.S. Department of Commerce, prepared this section.

TABLE 9.—*Soil series classified according to the current system of classification*

Series	Family	Subgroup	Order
Abell	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Altavista	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Angie	Clayey, mixed, thermic	Aquic Paleudults	Ultisols.
Angie variant	Clayey, mixed, thermic	Typic Paleudults	Ultisols.
Appling	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Ashlar	Coarse-loamy, mixed thermic	Typic Dystrochrepts	Inceptisols.
Atlee [1]	Fine-loamy, mixed, thermic	Typic Fragiudults	Ultisols.
Bertie	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Bourne	Fine-loamy, mixed, thermic	Typic Fragidults	Ultisols.
Buncombe	Mixed, thermic	Typic Udipsamments	Entisols.
Caroline	Clayey, mixed, thermic	Typic Paleudults	Ultisols.
Cecil	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Chastain	Fine, kaolinitic, acid, thermic	Typic Haplaquepts	Inceptisols.
Chewacla	Fine-loamy, mixed, thermic	Fluvaquentic Dystrochrepts	Inceptisols.
Colfax	Fine-loamy, mixed, thermic	Aquic Fragiudults	Ultisols.
Coxville	Clayey, kaolinitic, thermic	Typic Paleaquults	Ultisols.
Creedmoor	Clayey, mixed, thermic	Aquic Hapludults	Ultisols.
Duplin	Clayey, kaolinitic, thermic	Aquic Paleudults	Ultisols.
Faceville	Clayey, kaolinitic, thermic	Typic Paleudults	Ultisols.
Forestdale [2]	Fine, montmorillonitic, thermic	Typic Ochraqualfs	Alfisols.
Helena	Clayey, mixed, thermic	Aquic Hapludults	Ultisols.
Kalmia	Fine-loamy over sandy or sandy-skeletal, siliceous, thermic.	Typic Hapludults	Ultisols.
Kempsville	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Kinston	Fine-loamy, siliceous, acid, thermic	Typic Fluvaquents	Entisols.
Lenoir	Clayey, mixed, thermic	Aeric Paleaquults	Ultisols.
Lynchburg	Fine-loamy, siliceous, thermic	Aeric Paleaquults	Ultisols.
Mantachie	Fine-loamy, siliceous, acid, thermic	Aeric Fluvaquents	Entisols.
Mayodan [2]	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.
Myatt	Fine-loamy, siliceous, thermic	Typic Ochraquults	Ultisols.
Norfolk	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Orange	Fine, montmorillonitic, thermic	Albaquic Hapludalfs	Alfisols.
Pactolus	Thermic, coated	Aquic Quartzipsamments	Entisols.
Pamunkey	Fine-loamy, mixed, thermic	Ultic Hapludalfs	Alfisols.
Pinkston [2]	Coarse-loamy, mixed, thermic	Ruptic-Ultic Dystrochrepts	Inceptisols.
Portsmouth	Fine-loamy, mixed, thermic	Typic Umbraquults	Ultisols.
Pouncey	Clayey, mixed, thermic	Typic Albaquults	Ultisols.
Rains	Fine-loamy, siliceous, thermic	Typic Paleaquults	Ultisols.
Riverview	Fine-loamy, mixed, thermic	Fluventic Dystrochrepts	Inceptisols.
Roanoke	Clayey, mixed, thermic	Typic Ochraquults	Ultisols.
Rumford	Coarse-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Ruston	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisolts.
Sassafras [2]	Fine-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
State	Fine-loamy, mixed, thermic	Typic Hapludults	Ultisols.
Tetotum	Fine-loamy, mixed, thermic	Aquic Hapludults	Ultisols.
Toccoa	Coarse-loamy, mixed, nonacid, thermic	Typic Udifluvents	Entisols.
Turbeville	Clayey, mixed, thermic	Typic Paleudults	Ultisols.
Wedowee	Clayey, kaolinitic, thermic	Typic Hapludults	Ultisols.

[1] The Atlee series is currently being proposed for classification as Fragaquic Paleudults.
[2] These soils are taxadjuncts to the series for which they are named. They are outside the defined range of the series as follows:
Forestdale soils—a higher clay content in the lower part of the solum.
Mayodan soils—redder hue in the B2t horizon.
Pinkston soil—thinner solum.
Sassafras soils—slightly higher soil temperature.

small moderating effect on the climate. Although the area is near the main path of winter storms, the Appalachian Mountains to the west tend to lessen the intensity of the storms.

The county is often in the path of warm, moist air currents moving from the south or southwest and in the path of cold, dry air currents moving southward and eastward. These alternating currents frequently bring sharp changes in the day-to-day weather and contribute greatly to variations in weather from one season to another. Weather on a particular day in one part of the county may differ from that in another part, but elevation differences are not great enough to cause significant differences in climate. The climatological data in tables 10 and 11 may be considered approximately applicable to the entire county.

Mean annual temperatures vary slightly from year to year and are mostly 55° to 60° F. Maximum temperatures are 90° F or higher on an average of about 48 days per year, but they reach 100° F or more only about once every 3 years.Minimum temperatures are 32° F or lower about 80 to 100 days per year. Freezing temperatures occur on a few more days in rural areas than they do near urban areas. A few hard freezes occur in winter but temperatures of 0° F or below are very rare. Prolonged periods of very cold or

TABLE 10.—*Temperature and precipitation data*

[Data from records at Byrd Field, Richmond Virginia]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover 1 inch or more in depth	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	In	In	In	No	In
January	48	29	66	13	3.5	1.2	5.3	4	5
February	51	29	67	16	2.9	1.4	4.4	2	4
March	59	36	73	23	3.4	1.8	5.0	2	5
April	70	46	86	32	3.2	1.7	5.2	(1)	1
May	79	55	88	43	3.7	1.4	7.3		
June	87	63	93	53	3.8	1.2	8.2		
July	89	67	95	60	5.6	2.2	10.2		
August	86	65	94	56	5.5	1.8	9.2		
September	82	59	91	47	3.6	.8	7.5		
October	71	47	83	37	3.0	.9	5.3		
November	60	37	83	26	3.0	.8	5.3	(1)	2
December	50	30	66	16	3.0	1.3	4.7	2	4
Year	69	47	[2] 99	[3] 8	44.2	31.5	53.5	10	4

[1] Less than one-half day.
[2] Average annual highest temperature.
[3] Average annual lowest temperature.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from records of Byrd Field, Richmond, Virginia]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	February 28	March 17	March 29	April 11	April 28
2 years in 10 later than	February 23	March 10	March 22	April 6	April 22
5 years in 10 later than	February 12	February 23	March 11	March 28	April 12
Fall:					
1 year in 10 earlier than	December 5	November 19	November 8	October 25	October 15
2 years in 10 earlier than	December 12	November 24	November 12	October 31	October 21
5 years in 10 earlier than	December 19	December 4	November 23	November 10	October 30

very warm weather are unusual. There are occasional mild spells in winter, and periods of mild weather with lower humidities relieve- stretches of warm, humid weather in summer.

The frost-free growing season is about 200 days—long enough to allow proper maturity of a large variety of crops and to provide a long growing season for horticultural specialty crops without protection. The pasture season is a little longer, but winter months are cold enough to require some feeding and shelter of livestock.

Precipitation is quite variable over both long and short periods. Although rainfall is usually greatest in July and August, it is often insufficient for crop needs because this is the time when vegetation demands for moisture are greatest and evaporation is highest. Thundershowers occur on an average of 37 days per year, mostly in summer. Some of these showers are heavy and result in considerable runoff. Hurricanes pass inland every few years near the area and usually bring extremely heavy rains (fig. 10).

The average annual relative humidity is about 71 percent. Average relative humidity varies from about 63 percent in April to about 77 percent in August. Relative humidity throughout the day usually decreases as temperature rises. It averages about 82 percent in early morning when the temperature is low and falls to about 53 percent in early afternoon as the temperature increases.

Figure 10.—**Flooded area of Angie very fine sandy loam near the James River after Hurricane Camille in August 1969.**

The prevailing wind direction is south although winds are often from all directions. Southerly winds are most frequent in summer, but southerly to westerly winds prevail in all months except October and February, when the prevailing direction is north-northeast. The annual average windspeed is 7.7 miles per hour, ranging from 5.7 miles per hour in August to 9.1 miles per hour in March. Windspeeds are moderate except for a few times each year when windstorms may cause scattered local damage.

Cloud cover averages 60 percent between sunrise and sunset. Although cloud cover is least in fall, the percent of possible sunshine is greatest in summer when overcast days are less frequent.

Physiography, Relief, and Drainage

Henrico County lies astride the fall line, which is approximately along the right-of-way of the Richmond, Fredericksburg, and Potomac Railroad. The Atlantic Coastal Plain is east of the fall line, and the Piedmont Plateau is west of it. This line marks the head of navigation on the major streams; there are rapids upstream and tidal water downstream. Elevations in the county range from sea level along the lower James River to about 340 feet above sea level on the highest ridges in the western section of the county.

Generally, the Coastal Plain consists of broad, nearly level and gently sloping ridges. Slopes are moderate along drainageways, and steep between the Coastal Plain uplands and the terraces and flood plains of the Chickahominy and James Rivers and on sharp breaks between the river terraces. Soils on the Coastal Plain are commonly well drained or moderately well drained, but in some areas range from excessively drained to very poorly drained.

The Piedmont Plateau consists of gently sloping and sloping ridges. Slopes are moderate along drainageways and steep between the uplands and the terraces and flood plain of the James River. Soils on the Piedmont Plateau are commonly well drained or moderately well drained, but in some areas drainage is poor.

There is a large area of nearly level to gently sloping terraces along the lower part of the James River, extending from the city of Richmond southeast to the Charles City County line. The flood plain along the James River is rather narrow. A narrow flood plain is along the Chickahominy River, extending from about the point where U.S. Highway 1 crosses the river

eastward to the Charles City County line. The county is drained by the Chickahominy River, the James River, and their tributaries. The drainage pattern is dendritic, but it is irregularly branched. There are two large areas with weak drainage patterns and poor drainage. One is along Greenwood Road and the Richmond, Fredericksburg, and Potomac Railroad, and the other is at Byrd International Airport, extending through Sandston and Highland Springs.

Water Supply

There are numerous freshwater streams throughout most of the county. The lower part of the James River is tidal, and the water is brackish.

Ground water is generally of good quality. Shallow dug wells in the Piedmont Plateau yield adequate water for individual homes, except during periods of drought. Wells drilled deeply into granite usually yield limited quantities of water. Water supply in the Coastal Plain is usually abundant, but it is limited in some places. The underlying sand and gravel strata provide ample water for individual homes at a depth of 25 to 40 feet. There is a high-yielding, deep-drilled well in the Bradley Acres subdivision along Interstate 64 near Bottoms Bridge.

The James River supplies water for much of the urban area in the county as well as for the city of Richmond. The Chickahominy River, its large tributaries, and the James River are additional potential sources of water.

Geology

Henrico County is on the fall line, with the western section on the Piedmont Pletau and the eastern section on the Atlantic Coastal Plain. The oldest formation is the Precambrian Petersburg Granite of the Piedmont Plateau. The next oldest formation is the Triassic sandstone and shale of the Newark Series along Tuckahoe Creek and Deep Run Creek. Below the fall line the granite is overlain with Coastal Plain sediments. Directly on top of the granite is the Potomac Group, consisting of arkosic sands and clays of Early Cretaceous age. These are over 240 feet thick. Abundant water is available in this formation. Directly above the Potomac Group is the Pamunkey Group, of Eocene age, consisting of glauconitic sands and marl. These are approximately 30 feet thick and have a limited water supply. The next oldest formation is the Chesapeake Group represented by the Calvert Formation of Miocene age, and consisting of clay, silt, sand, and marl. This is about 60 feet thick. There is a limited supply of hard water in this formation. The youngest sedimentary deposit is the Columbia Group, of Pleistocene age, consisting of about 20 feet of water-bearing sand and gravel overlain with 20 feet of clay. Good-quality water is available from shallow or driven wells, but the yield is usually less than 5 gallons per minute.

The Piedmont Plateau has thin gravelly, sandy, and clayey sedimentary deposits on the highest ridges, which are thought to be remnants of the Brandywine terrace and old river terraces. The Brandywine terrace is the oldest and highest terrace of the Coastal Plain. The next youngest, the Sunderland terrace, is of fluvial origin and the most extensive. It is at elevations ranging from approximately 100 to 200 feet above sea level. There are small areas of the Wicomico terrace at elevations of 60 to 90 feet, significant areas of the Chowan terrace at elevations of 30 to 45 feet, and areas of the Dismal Swamp terrace at elevations of 10 to 15 feet. There are small areas of the Princess Anne terrace at elevations of 0 to 15 feet. The Wicomico, Chowan, and Dismal Swamp terraces consist of fluvial deposits of the James and Chickahominy Rivers. The Princess Anne terrace is of marine origin.

There are many sand and gravel deposits of commercial value in the Coastal Plain (*10*). There is an extensive supply of granite that is of excellent quality for building and road stone in the Piedmont Plateau. There are coal beds in the Triassic basin along Tuckahoe Creek and Deep Run Creek. The first coal mined in this country was taken from the Richmond Triassic basin in 1750. Coal mining here ceased in 1904. Philadelphia secured coal here preceeding development of mines in Pennsylvania.

Industry and Farming

The county is in an excellent geographical position for industrial development. Adequate highways, railroads, an international airport, and port facilities on the James River provide ample world-wide transportation. Tobacco products, sawmill products, building supplies, paper products, machinery, pharmaceutical supplies, and stationery and office equipment are manufactured in Henrico County. The sand and gravel operations in the eastern section of the county are extensive, and many concrete products are manufactured. There is a large area of sand and gravel deposits available for future development.

Industrial development is increasing and agriculture is decreasing in the county. Metropolitan Richmond is spreading into the county at an increasing rate. Subdivision developments are scattered throughout the county. Apartment developments are becoming of much greater importance near Richmond where land values are high.

Most of the dairy and poultry farms, once important, have ceased operation. Most of the agriculture is concentrated in the eastern part of the county, where farms produce beef cattle and general field crops, such as soybeans, corn, wheat, barley, and oats. Clover grass and alfalfa hay are produced along with silage for livestock feed. There are several greenhouses and nurseries that grow flowers and nursery stock.

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Glossary

Acidity. See Reaction, soil.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (Also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gneiss. A crystalline rock in which the component minerals are arranged in parallel bands or layers. This rock tends to cleave into slabs.

Grassed waterways. A waterway planted to grass to protect it against erosion; sometimes graded or shaped to control runoff.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Leaching soil. Removal of materials in solution by the passage of water through soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical mineral, and biological properties of the various horizons, and their thickness and arrangement of the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: fine, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Schist. A rock that has a parallel or foliated structure secondarily developed in it by shearing, a process generally accompanied by more or less recrystallization of the constituent minerals in layers parallel to the cleavage; splits or cleaves readily.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Triassic. The earliest period of the Mesozoic era occurring in the geological time scale.

Upland (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit refer both to the description of the mapping unit and the soil series to which the mapping unit belongs. In referring to a capability unit or a woodland suitability group, read the introduction to its section for general information about its management. Potential productivity, suitable trees for planting, and hazards of woodland management for each woodland group are given in table 3. Other information is given in tables as follows:

Acreage and extent, table 1, p. 7.
Estimated yields, table 2, p. 61.
Soil interpretations for wildlife habitat, table 4, p. 68.
Engineering uses of the soils, tables 5, 6, and 7, pp. 74 through 93.
Limitations of soils for town and country planning, table 8, p. 98.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
AbB	Abell fine sandy loam, 2 to 6 percent slopes	8	IIw-1	54	2o1
AfA	Altavista fine sandy loam, 0 to 2 percent slopes	8	IIw-2	55	2o1
AfB	Altavista fine sandy loam, 2 to 6 percent slopes	9	IIe-2	53	2o1
AgA	Angie loam, 0 to 2 percent slopes	9	IIw-2	55	3o1
AgB	Angie loam, 2 to 6 percent slopes	10	IIe-2	53	3o1
AgB2	Angie loam, 2 to 6 percent slopes, eroded	10	IIe-2	53	3o1
AgC2	Angie loam, 6 to 10 percent slopes, eroded	10	IIIe-2	56	3o1
AgE2	Angie loam, 10 to 25 percent slopes, eroded	10	IVe-3	58	3r1
Ak	Angie loam, concretionary subsoil variant	11	IIw-2	55	3o1
AmB	Appling fine sandy loam, 2 to 6 percent slopes	12	IIe-1	53	3o1
AmC2	Appling fine sandy loam, 6 to 15 percent slopes, eroded	12	IIIe-1	55	3o1
AmE2	Appling fine sandy loam, 15 to 25 percent slopes, eroded	12	IVe-1	58	3r1
AoC3	Appling clay loam, 2 to 15 percent slopes, severely eroded	12	IVe-2	58	4c1
AQ	Aquents, loamy	13	VIw-1	59	---
AsD	Ashlar gravelly sandy loam, 6 to 15 percent slopes	13	IVe-4	58	3d1
AsE	Ashlar gravelly sandy loam, 15 to 45 percent slopes	13	VIe-1	59	3d1
At	Atlee very fine sandy loam	14	IIw-2	55	3o1
Be	Bertie fine sandy loam	15	IIIw-1	57	3w1
BoA	Bourne fine sandy loam, 0 to 2 percent slopes	16	IIw-2	55	4d1
BoB	Bourne fine sandy loam, 2 to 6 percent slopes	16	IIe-2	53	4d1
BoC	Bourne fine sandy loam, 6 to 10 percent slopes	16	IIIe-2	56	4d1
Bu	Buncombe loamy fine sand	17	IIIs-1	58	2s1
CaB2	Caroline very fine sandy loam, 2 to 6 percent slopes, eroded	17	IIe-1	53	3o1
CaC2	Caroline very fine sandy loam, 6 to 10 percent slopes, eroded	18	IIIe-1	55	3o1
CaD2	Caroline very fine sandy loam, 10 to 15 percent slopes, eroded	18	IVe-1	58	3o1
CbC3	Caroline clay loam, 2 to 10 percent slopes, severely eroded	18	IVe-2	58	4c1
CeC2	Cecil fine sandy loam, 2 to 10 percent slopes, eroded	19	IIIe-1	55	3o1
CeD2	Cecil fine sandy loam, 10 to 25 percent slopes, eroded	19	IVe-1	58	3r1
CfD3	Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded	19	IVe-2	58	4c1
Cg	Chastain silt loam	20	IVw-1	59	3w2
Ch	Chewacla silt loam	20	IIIw-3	57	1w1
Ck	Chewacla silt loam, clayey substratum	20	IIIw-3	57	1w1
Cm	Chewacla and Riverview soils	20	IIIw-3	57	1w1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
CoB	Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes	21	IIIw-2	57	2w1
Cp	Coxville silt loam	22	IVw-1	59	3w2
CvB	Creedmoor sandy loam, 2 to 6 percent slopes	23	IIe-3	54	4c1
CvB2	Creedmoor sandy loam, 2 to 6 percent slopes, eroded	23	IIIe-3	57	4c1
CvC2	Creedmoor sandy loam, 6 to 10 percent slopes, eroded	23	IVe-3	58	4c1
DuB2	Duplin very fine sandy loam, 2 to 6 percent slopes, eroded	24	IIe-2	53	3o1
DuC2	Duplin very fine sandy loam, 6 to 10 percent slopes, eroded	24	IIIe-2	56	3o1
DuD2	Duplin very fine sandy loam, 10 to 15 percent slopes, eroded	24	IVe-3	58	3o1
DvA	Duplin silt loam, 0 to 2 percent slopes	24	IIw-2	55	3o1
DwC3	Duplin clay loam, 2 to 10 percent slopes, severely eroded	24	IVe-2	58	4c1
FaA	Faceville fine sandy loam, 0 to 2 percent slopes	25	I-1	53	3o1
FaB2	Faceville fine sandy loam, 2 to 6 percent slopes, eroded	25	IIe-1	53	3o1
FL	Fluvaquents	25	VIIw-1	59	---
Fo	Forestdale silt loam	26	IVw-1	59	1w2
HeB	Helena fine sandy loam, 2 to 6 percent slopes	27	IIe-3	54	4c1
HeB2	Helena fine sandy loam, 2 to 6 percent slopes, eroded	27	IIIe-3	57	4c1
HeC2	Helena fine sandy loam, 6 to 15 percent slopes, eroded	27	IVe-3	58	4c1
HS	Hydraquents	27	VIIw-1	59	---
KaA	Kalmia fine sandy loam, 0 to 2 percent slopes	28	IIw-1	54	2o1
KaC	Kalmia fine sandy loam, 2 to 10 percent slopes	28	IIIe-1	55	2o1
KeA	Kempsville fine sandy loam, 0 to 2 percent slopes	29	I-1	53	3o1
KeB	Kempsville fine sandy loam, 2 to 6 percent slopes	29	IIe-1	53	3o1
KeC2	Kempsville fine sandy loam, 2 to 10 percent slopes, eroded	29	IIIe-1	55	3o1
KeD2	Kempsville fine sandy loam, 10 to 25 percent slopes, eroded	29	IVe-1	58	3r2
KfA	Kempsville fine sandy loam, flooded, 0 to 2 percent slopes	29	IIw-1	54	3o1
KfB	Kempsville fine sandy loam, flooded, 2 to 6 percent slopes	29	IIw-1	54	3o1
KgA	Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes	30	I-1	53	3o1
KgB	Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes	30	IIe-1	53	3o1
KgC2	Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded	30	IIIe-1	55	3o1
Km	Kinston silt loam	31	IVw-1	59	2w3
Kn	Kinston and Mantachie soils	31	IVw-1	59	2w3
Le	Lenoir silt loam	31	IIIw-1	57	3w1
Ly	Lynchburg fine sandy loam	32	IIIw-1	57	2w2
Mc	Mantachie-Chastain complex	33	IVw-1	59	3w2
MdB2	Mayodan fine sandy loam, 2 to 6 percent slopes, eroded	34	IIe-1	53	3o1
My	Myatt fine sandy loam	34	IVw-1	59	2w3
NoA	Norfolk fine sandy loam, 0 to 2 percent slopes	35	I-1	53	3o1
NoB	Norfolk fine sandy loam, 2 to 6 percent slopes	35	IIe-1	53	3o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland suitability group
			Symbol	Page	Symbol
NoC	Norfolk fine sandy loam, 6 to 10 percent slopes--	36	IIIe-1	55	3o1
OUD	Ochrepts and Udults, sloping----------	36	VIe-1	59	2o1
OUF	Ochrepts and Udults, steep----------	36	VIIe-1	59	2r1
Ov	Orange loam----------	37	IIIw-1	57	4w1
OW	Orthents-Udults-Mine pits complex----------	37	VIIe-1	59	---
Pa	Pactolus loamy fine sand----------	38	IIIs-1	57	2s1
PmA	Pamunkey fine sandy loam, 0 to 2 percent slopes--	39	I-1	53	2o1
PmB	Pamunkey fine sandy loam, 2 to 6 percent slopes--	39	IIe-1	53	2o1
PmD	Pamunkey fine sandy loam, 6 to 15 percent slopes----------	39	IIIe-1	55	2o1
PnC3	Pamunkey clay loam, 6 to 15 percent slopes, severely eroded----------	39	IVe-2	58	2o1
PoE	Pinkston fine sandy loam, 6 to 25 percent slopes----------	40	VIe-1	59	4d2
Pr	Portsmouth silt loam----------	40	IVw-1	59	2w3
Ps	Pouncey sandy loam----------	41	IVw-1	59	2w3
PTB	Psamments, gently sloping----------	41	------	--	---
Ra	Rains very fine sandy loam----------	42	IVw-1	59	2w3
Re	Riverview silt loam----------	42	IIw-1	54	1o1
Ro	Roanoke silt loam----------	43	IVw-1	59	1w2
RrC	Rumford loamy sand, 0 to 10 percent slopes-------	44	IIIs-1	57	3o1
RuA	Ruston fine sandy loam, 0 to 2 percent slopes----	44	I-1	53	2o1
RuB	Ruston fine sandy loam, 2 to 6 percent slopes----	45	IIe-1	53	2o1
RuC2	Ruston fine sandy loam, 6 to 10 percent slopes, eroded----------	45	IIIe-1	55	2o1
SsA	Sassafras fine sandy loam, 0 to 2 percent slopes----------	46	I-1	53	3o1
SsB	Sassafras fine sandy loam, 2 to 6 percent slopes----------	46	IIe-1	53	3o1
StA	State fine sandy loam, clayey substratum, 0 to 2 percent slopes----------	46	I-1	53	3o1
StB	State fine sandy loam, clayey substratum, 2 to 6 percent slopes----------	47	IIe-1	53	3o1
StC2	State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded----------	47	IIIe-1	55	3o1
SvB	State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes----------	47	IIe-1	53	3o1
Td	Tetotum loam, flooded----------	48	IIw-1	54	3o1
Te	Tetotum fine sandy loam----------	48	IIw-2	54	3o1
To	Toccoa fine sandy loam----------	48	IIw-1	54	1o1
TuA	Turbeville fine sandy loam, 0 to 2 percent slopes----------	49	I-1	53	3o1
TuB	Turbeville fine sandy loam, 2 to 6 percent slopes----------	49	IIe-1	53	3o1
TuC2	Turbeville fine sandy loam, 6 to 10 percent slopes, eroded----------	49	IIIe-1	55	3o1
TvB	Turbeville gravelly fine sandy loam, 2 to 6 percent slopes----------	50	IIe-1	53	3o1
TvC	Turbeville gravelly fine sandy loam, 6 to 10 percent slopes----------	50	IIIe-1	55	3o1
UD	Udorthents, clayey----------	50	------	--	---
UE	Udorthents, loamy----------	50	------	--	---
UR	Urban land----------	50	------	--	---
WeB	Wedowee sandy loam, 2 to 6 percent slopes--------	51	IIe-1	53	3o1
WeD	Wedowee sandy loam, 6 to 15 percent slopes-------	51	IIIe-1	55	3o1

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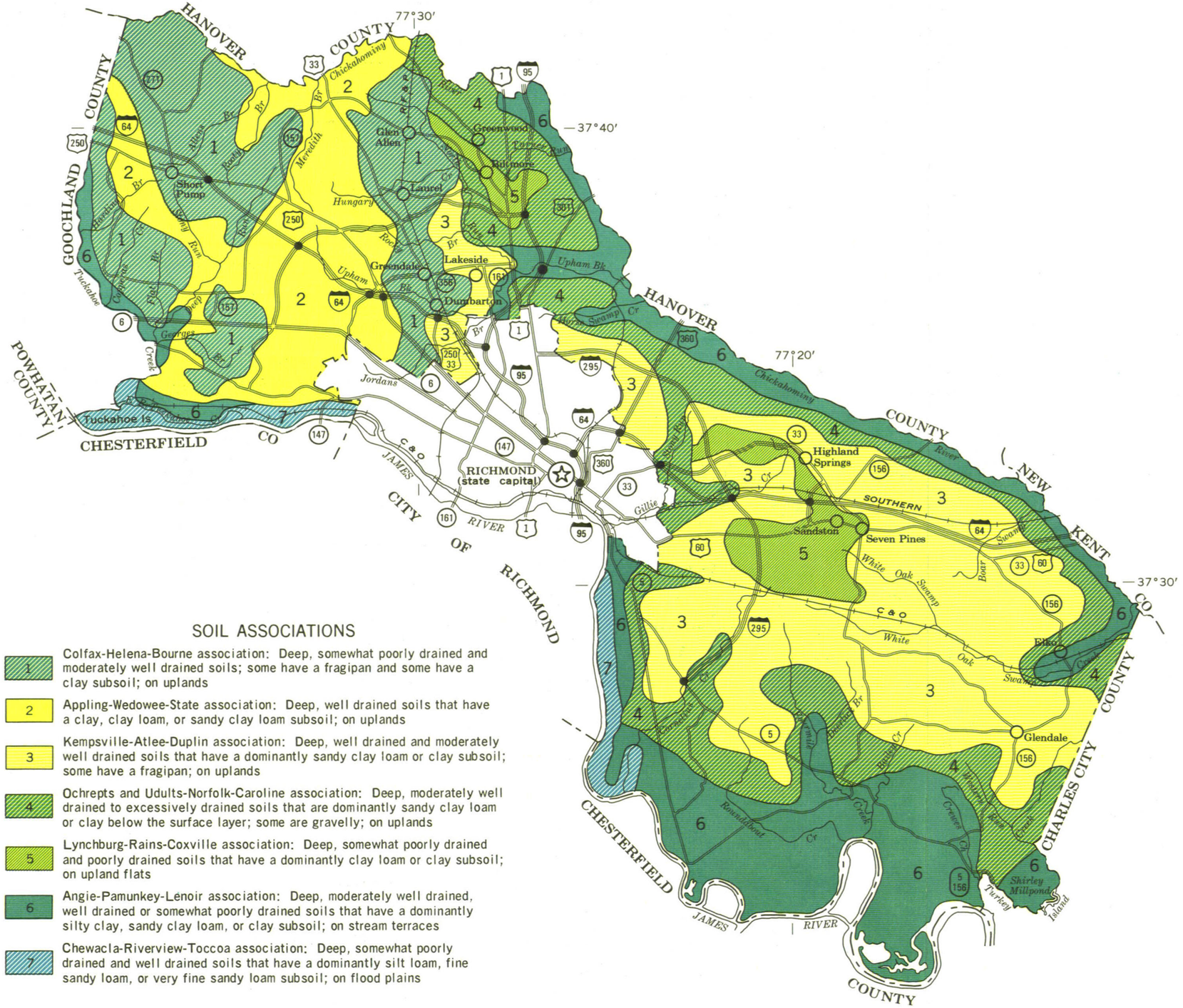


SOIL ASSOCIATIONS

1. Colfax-Helena-Bourne association: Deep, somewhat poorly drained and moderately well drained soils; some have a fragipan and some have a clay subsoil; on uplands
2. Appling-Wedowee-State association: Deep, well drained soils that have a clay, clay loam, or sandy clay loam subsoil; on uplands
3. Kempsville-Atlee-Duplin association: Deep, well drained and moderately well drained soils that have a dominantly sandy clay loam or clay subsoil; some have a fragipan; on uplands
4. Ochrepts and Udults-Norfolk-Caroline association: Deep, moderately well drained to excessively drained soils that are dominantly sandy clay loam or clay below the surface layer; some are gravelly; on uplands
5. Lynchburg-Rains-Coxville association: Deep, somewhat poorly drained and poorly drained soils that have a dominantly clay loam or clay subsoil; on upland flats
6. Angie-Pamunkey-Lenoir association: Deep, moderately well drained, well drained or somewhat poorly drained soils that have a dominantly silty clay, sandy clay loam, or clay subsoil; on stream terraces
7. Chewacla-Riverview-Toccoa association: Deep, somewhat poorly drained and well drained soils that have a dominantly silt loam, fine sandy loam, or very fine sandy loam subsoil; on flood plains

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

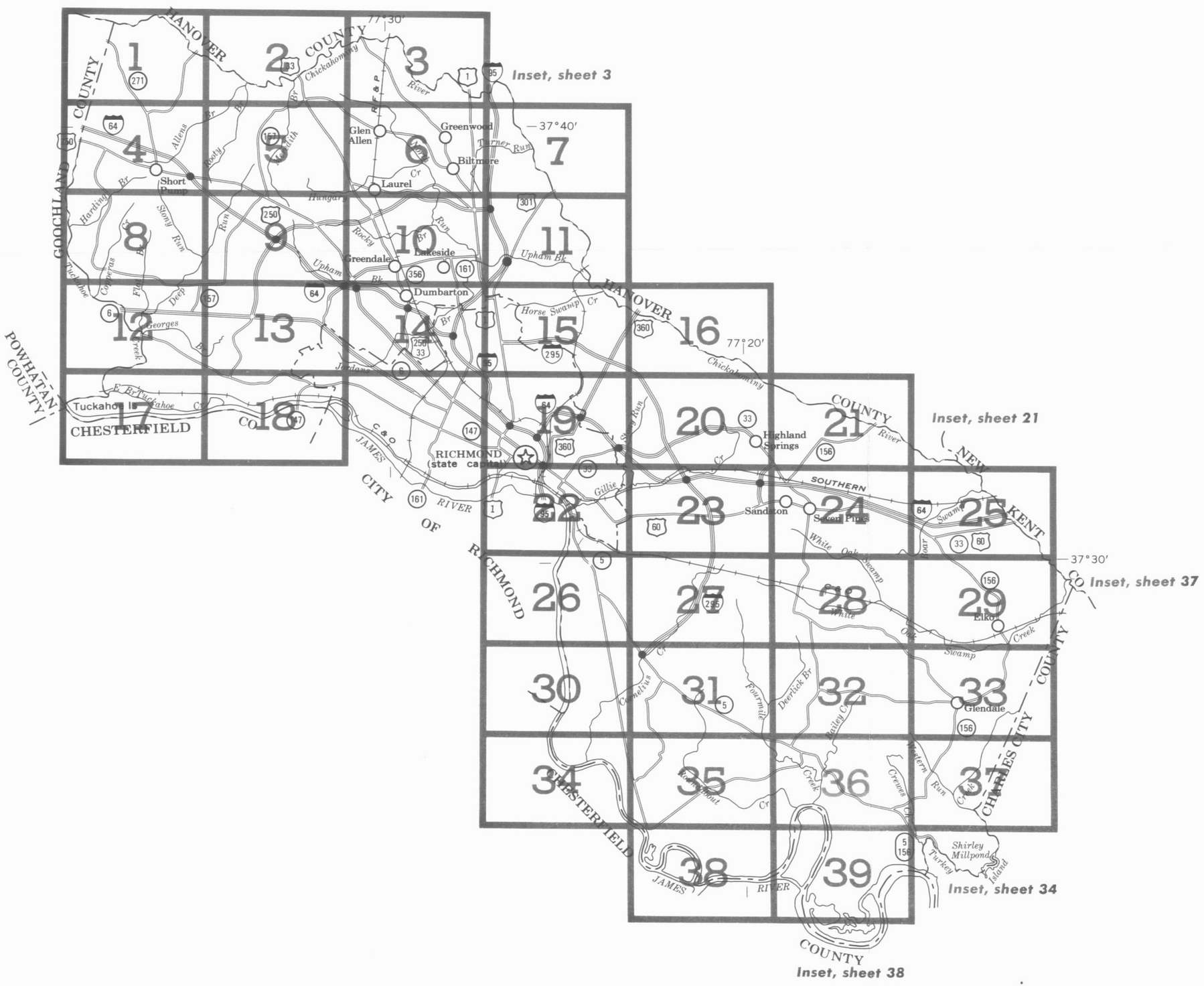
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

GENERAL SOIL MAP

HENRICO COUNTY, VIRGINIA

Scale 1:190,080

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

HENRICO COUNTY, VIRGINIA

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the mapping unit is broadly defined; otherwise, it is a small letter. The third letter, always a capital, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for broadly defined units that have a fair to considerable range of slope. A final number, 2 or 3, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
AbB	Abell fine sandy loam, 2 to 6 percent slopes
AfA	Altavista fine sandy loam, 0 to 2 percent slopes
AfB	Altavista fine sandy loam, 2 to 6 percent slopes
AgA	Angie loam, 0 to 2 percent slopes
AgB	Angie loam, 2 to 6 percent slopes
AgB2	Angie loam, 2 to 6 percent slopes, eroded
AgC2	Angie loam, 6 to 10 percent slopes, eroded
AgE2	Angie loam, 10 to 25 percent slopes, eroded
Ak	Angie loam, concretionary subsoil variant
AmB	Appling fine sandy loam, 2 to 6 percent slopes
AmC2	Appling fine sandy loam, 6 to 15 percent slopes, eroded
AmE2	Appling fine sandy loam, 15 to 25 percent slopes, eroded
AoC3	Appling clay loam, 2 to 15 percent slopes, severely eroded
AQ	Aquents, loamy *
AsD	Ashlar gravelly sandy loam, 6 to 15 percent slopes
AsE	Ashlar gravelly sandy loam, 15 to 45 percent slopes
At	Atlee very fine sandy loam
Be	Bertie fine sandy loam
BoA	Bourne fine sandy loam, 0 to 2 percent slopes
BoB	Bourne fine sandy loam, 2 to 6 percent slopes
BoC	Bourne fine sandy loam, 6 to 10 percent slopes
Bu	Buncombe loamy fine sand
CaB2	Caroline very fine sandy loam, 2 to 6 percent slopes, eroded
CaC2	Caroline very fine sandy loam, 6 to 10 percent slopes, eroded
CaD2	Caroline very fine sandy loam, 10 to 15 percent slopes, eroded
CbC3	Caroline clay loam, 2 to 10 percent slopes, severely eroded
CeC2	Cecil fine sandy loam, 2 to 10 percent slopes, eroded
CeD2	Cecil fine sandy loam, 10 to 25 percent slopes, eroded
CfD3	Cecil and Turbeville clay loams, 6 to 25 percent slopes, severely eroded
Cg	Chastain silt loam
Ch	Chewacla silt loam
Ck	Chewacla silt loam, clayey substratum
Cm	Chewacla and Riverview soils
CoB	Colfax fine sandy loam, indurated substratum, 0 to 6 percent slopes
Cp	Coxville silt loam
CvB	Creedmoor sandy loam, 2 to 6 percent slopes
CvB2	Creedmoor sandy loam, 2 to 6 percent slopes, eroded
CvC2	Creedmoor sandy loam, 6 to 10 percent slopes, eroded
DuB2	Duplin very fine sandy loam, 2 to 6 percent slopes, eroded
DuC2	Duplin very fine sandy loam, 6 to 10 percent slopes, eroded
DuD2	Duplin very fine sandy loam, 10 to 15 percent slopes, eroded
DvA	Duplin silt loam, 0 to 2 percent slopes
DwC3	Duplin clay loam, 2 to 10 percent slopes, severely eroded
FaA	Faceville fine sandy loam, 0 to 2 percent slopes
FaB2	Faceville fine sandy loam, 2 to 6 percent slopes, eroded
FL	Fluvaquents *
Fo	Forestdale silt loam
HeB	Helena fine sandy loam, 2 to 6 percent slopes
HeB2	Helena fine sandy loam, 2 to 6 percent slopes, eroded
HeC2	Helena fine sandy loam, 6 to 15 percent slopes, eroded
HS	Hydraquents *
KaA	Kalmia fine sandy loam, 0 to 2 percent slopes
KaC	Kalmia fine sandy loam, 2 to 10 percent slopes
KeA	Kempsville fine sandy loam, 0 to 2 percent slopes
KeB	Kempsville fine sandy loam, 2 to 6 percent slopes
KeC2	Kempsville fine sandy loam, 2 to 10 percent slopes, eroded
KeD2	Kempsville fine sandy loam, 10 to 25 percent slopes, eroded
KfA	Kempsville fine sandy loam, flooded, 0 to 2 percent slopes
KfB	Kempsville fine sandy loam, flooded, 2 to 6 percent slopes
KgA	Kempsville very fine sandy loam, clayey substratum, 0 to 2 percent slopes
KgB	Kempsville very fine sandy loam, clayey substratum, 2 to 6 percent slopes
KgC2	Kempsville very fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded
Km	Kinston silt loam
Kn	Kinston and Mantachie soils
Le	Lenoir silt loam
Ly	Lynchburg fine sandy loam
Mc	Mantachie-Chastain complex
MdB2	Mayodan fine sandy loam, 2 to 6 percent slopes, eroded
My	Myatt fine sandy loam
NoA	Norfolk fine sandy loam, 0 to 2 percent slopes
NoB	Norfolk fine sandy loam, 2 to 6 percent slopes
NoC	Norfolk fine sandy loam, 6 to 10 percent slopes
OUD	Ochrepts and Udults, sloping *
OUF	Ochrepts and Udults, steep *
Ov	Orange loam
OW	Orthents-Udults-Mine pits complex *
Pa	Pactolus loamy fine sand
PmA	Pamunkey fine sandy loam, 0 to 2 percent slopes
PmB	Pamunkey fine sandy loam, 2 to 6 percent slopes
PmD	Pamunkey fine sandy loam, 6 to 15 percent slopes
PnC3	Pamunkey clay loam, 6 to 15 percent slopes, severely eroded
PoE	Pinkston fine sandy loam, 6 to 25 percent slopes
Pr	Portsmouth silt loam
Ps	Pouncey sandy loam
PTB	Psamments, gently sloping *
Ra	Rains very fine sandy loam
Re	Riverview silt loam
Ro	Roanoke silt loam
RrC	Rumford loamy sand, 0 to 10 percent slopes
RuA	Ruston fine sandy loam, 0 to 2 percent slopes
RuB	Ruston fine sandy loam, 2 to 6 percent slopes
RuC2	Ruston fine sandy loam, 6 to 10 percent slopes, eroded
SsA	Sassafras fine sandy loam, 0 to 2 percent slopes
SsB	Sassafras fine sandy loam, 2 to 6 percent slopes
StA	State fine sandy loam, clayey substratum, 0 to 2 percent slopes
StB	State fine sandy loam, clayey substratum, 2 to 6 percent slopes
StC2	State fine sandy loam, clayey substratum, 6 to 10 percent slopes, eroded
SvB	State gravelly fine sandy loam, clayey substratum, 2 to 6 percent slopes
Te	Tetotum fine sandy loam
Td	Tetotum loam, flooded
To	Toccoa fine sandy loam
TuA	Turbeville fine sandy loam, 0 to 2 percent slopes
TuB	Turbeville fine sandy loam, 2 to 6 percent slopes
TuC2	Turbeville fine sandy loam, 6 to 10 percent slopes, eroded
TvB	Turbeville gravelly fine sandy loam, 2 to 6 percent slopes
TvC	Turbeville gravelly fine sandy loam, 6 to 10 percent slopes
UD	Udorthents, clayey *
UE	Udorthents, loamy *
UR	Urban land *
WeB	Wedowee sandy loam, 2 to 6 percent slopes
WeD	Wedowee sandy loam, 6 to 15 percent slopes

* The composition of these units is more variable than that of the others in the survey area, but has been controlled well enough to be interpreted for the expected uses of the soils.

1

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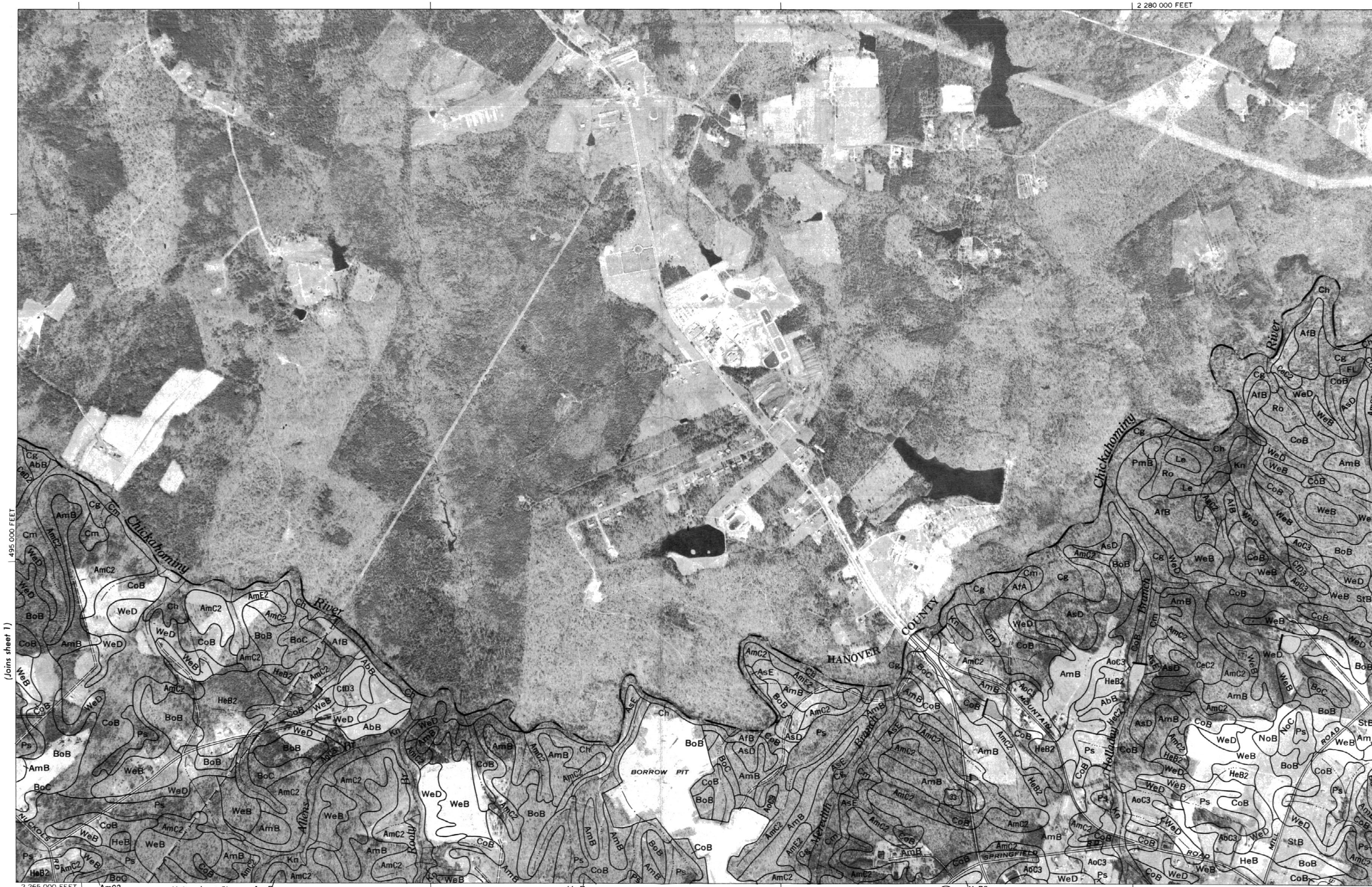
HENRICO COUNTY, VIRGINIA NO. 1

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 2



N

Scale 1:15840

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

HENRICO COUNTY, VIRGINIA NO. 2

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HENRICO COUNTY, VIRGINIA NO. 3

2 285 000 FEET

500 000 FEET

Chickahominy River

HANOVER COUNTY

RICHMOND FREDERICKSBURG RAILROAD

BROOK ROAD

(Joins sheet 2)

(Joins sheet 6)

2 300 000 FEET

2 305 000 FEET

494 000 FEET

491 000 FEET

2 307 000 FEET

(Joins lower right)

(Joins sheet 7)

2000 AND 5000-FOOT GRID TICKS

3

N

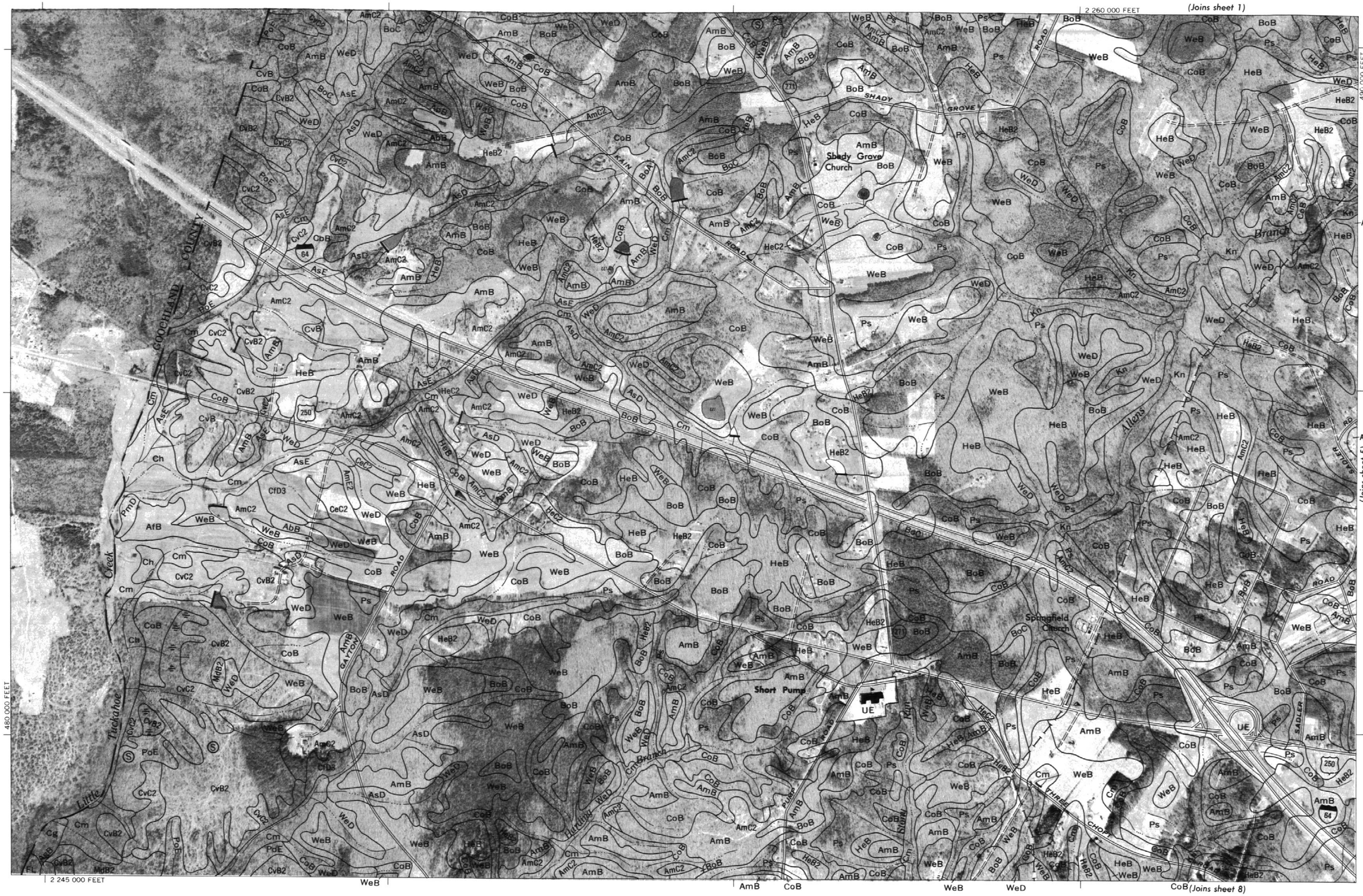
1 Mile

5 000 Feet

Scale 1:15840

1 495 000 FEET

(Joins inset)



HENRICO COUNTY, VIRGINIA NO. 4

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HENRICO COUNTY, VIRGINIA NO. 5

HENRICO COUNTY, VIRGINIA — SHEET NO. 6

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HENRICO COUNTY, VIRGINIA NO. 7

N

1 Mile

5,000 Feet

Scale 1:15840

0 0 ¼ ½ ¾ 1 1000 2000 3000 4000 5000

2 260 000 FEET

475 000 FEET

470 000 FEET

2 245 000 FEET

(Joins sheet 4)

(Joins sheet 9)

(Joins sheet 12)

HENRICO COUNTY, VIRGINIA NO. 8

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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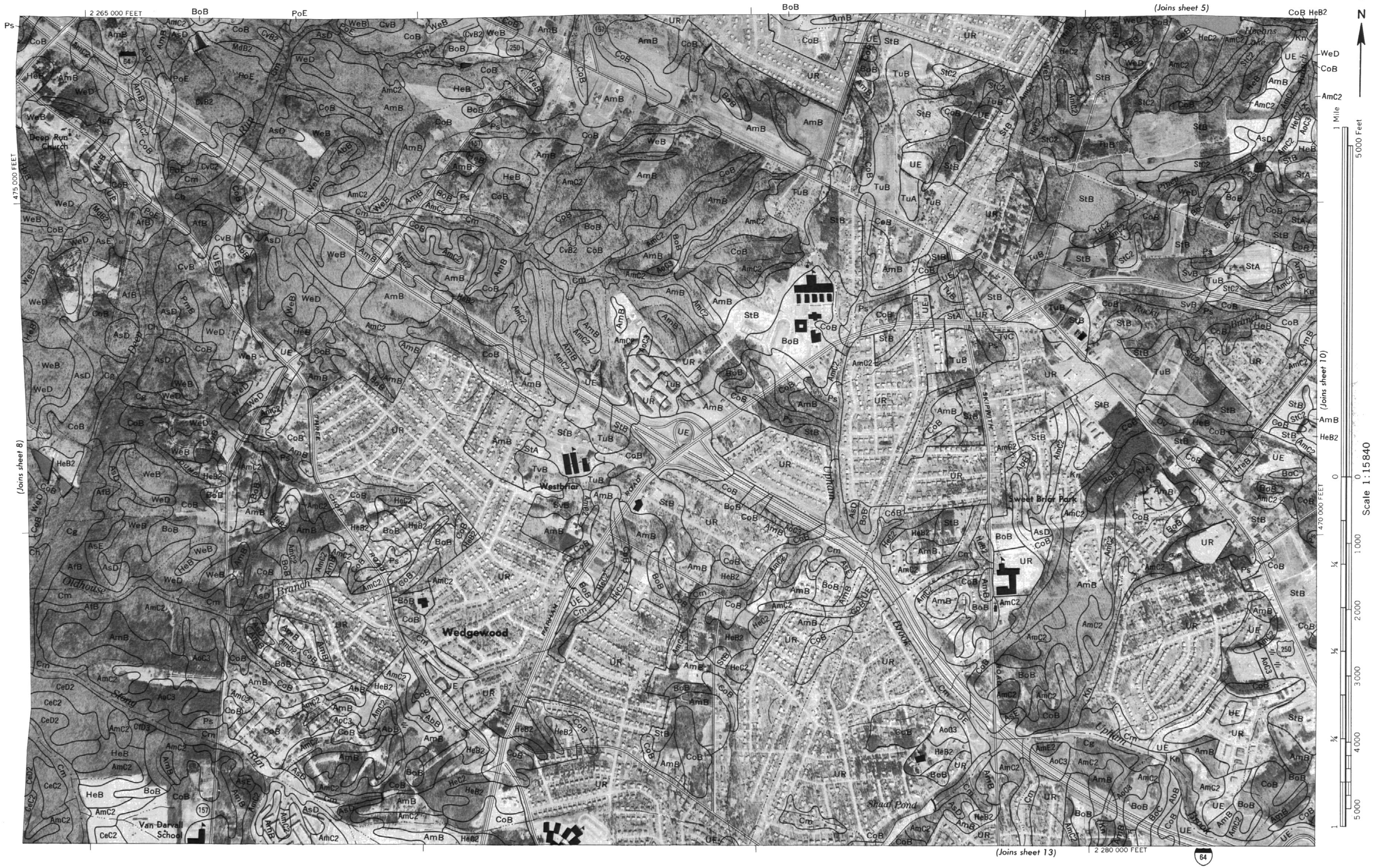

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Virginia Polytechnic Institute and State University.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 9

HENRICO COUNTY, VIRGINIA NO. 10

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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N

(Joins sheet 7)

(Joins sheet 10)

(Joins sheet 15)

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 11

1 Mile
5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

HENRICO COUNTY, VIRGINIA NO. 12

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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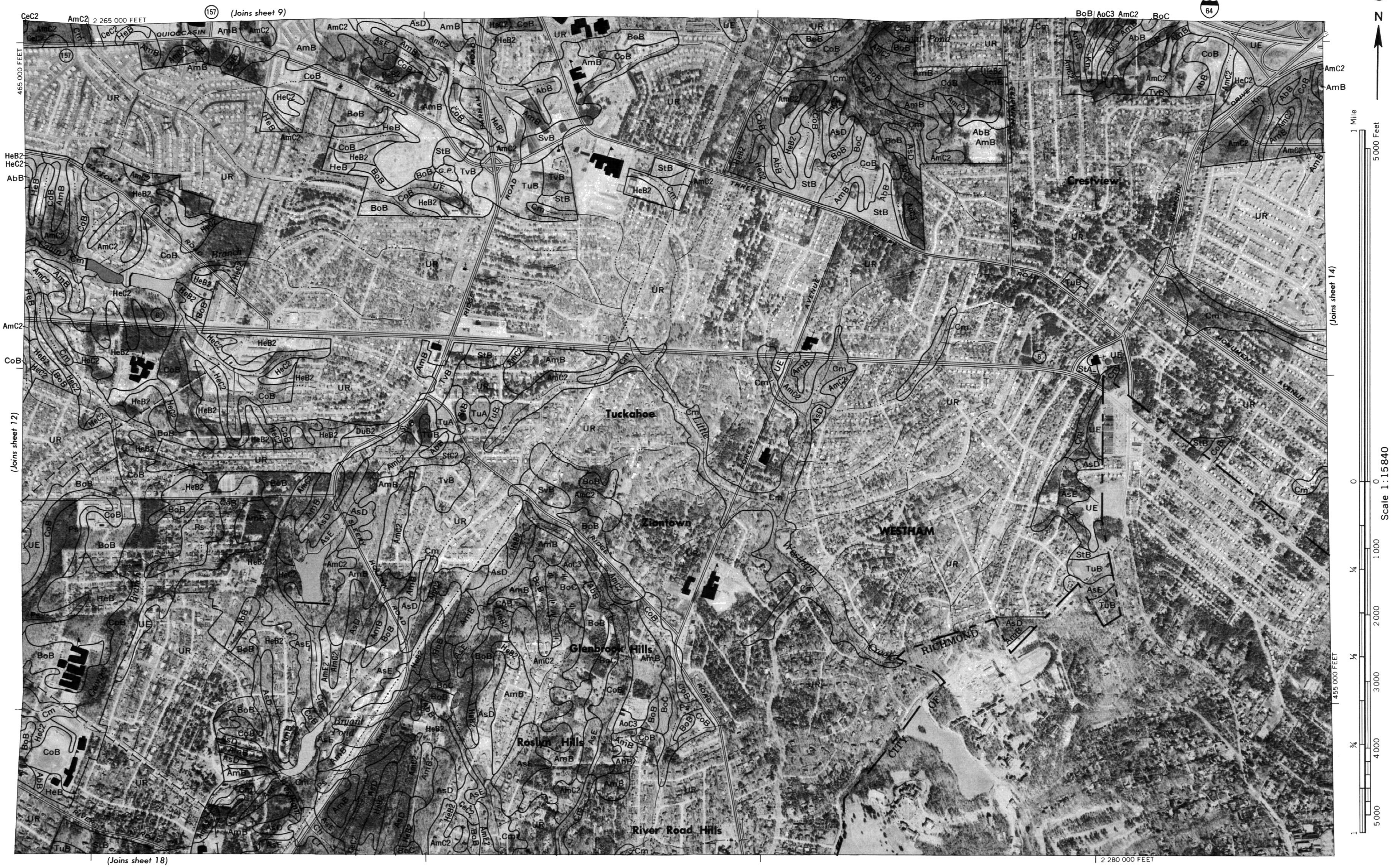
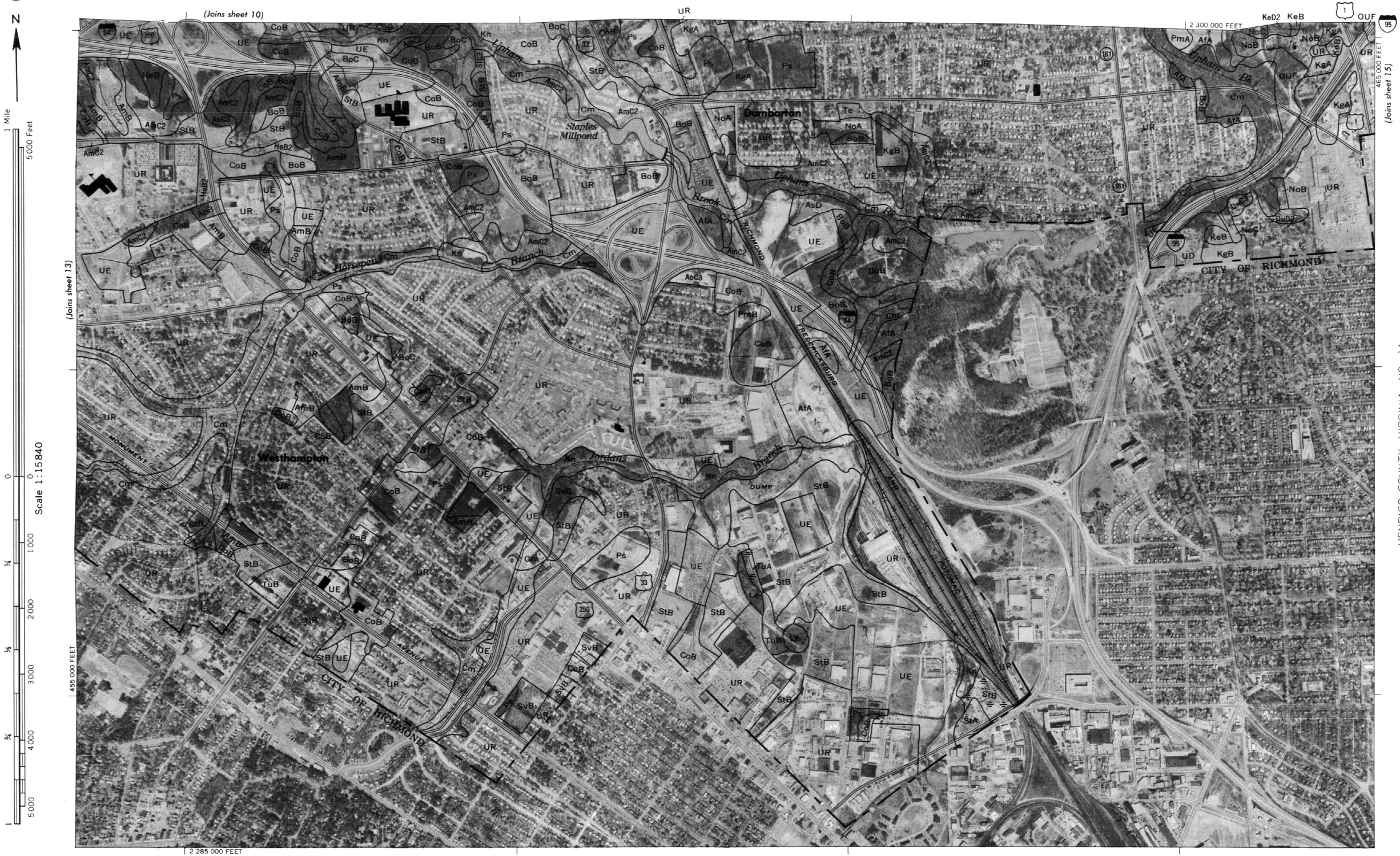


This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Virginia Polytechnic Institute and State University.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 13



HENRICO COUNTY, VIRGINIA — SHEET NO. 14

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 15

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 16

HENRICO COUNTY, VIRGINIA NO. 16

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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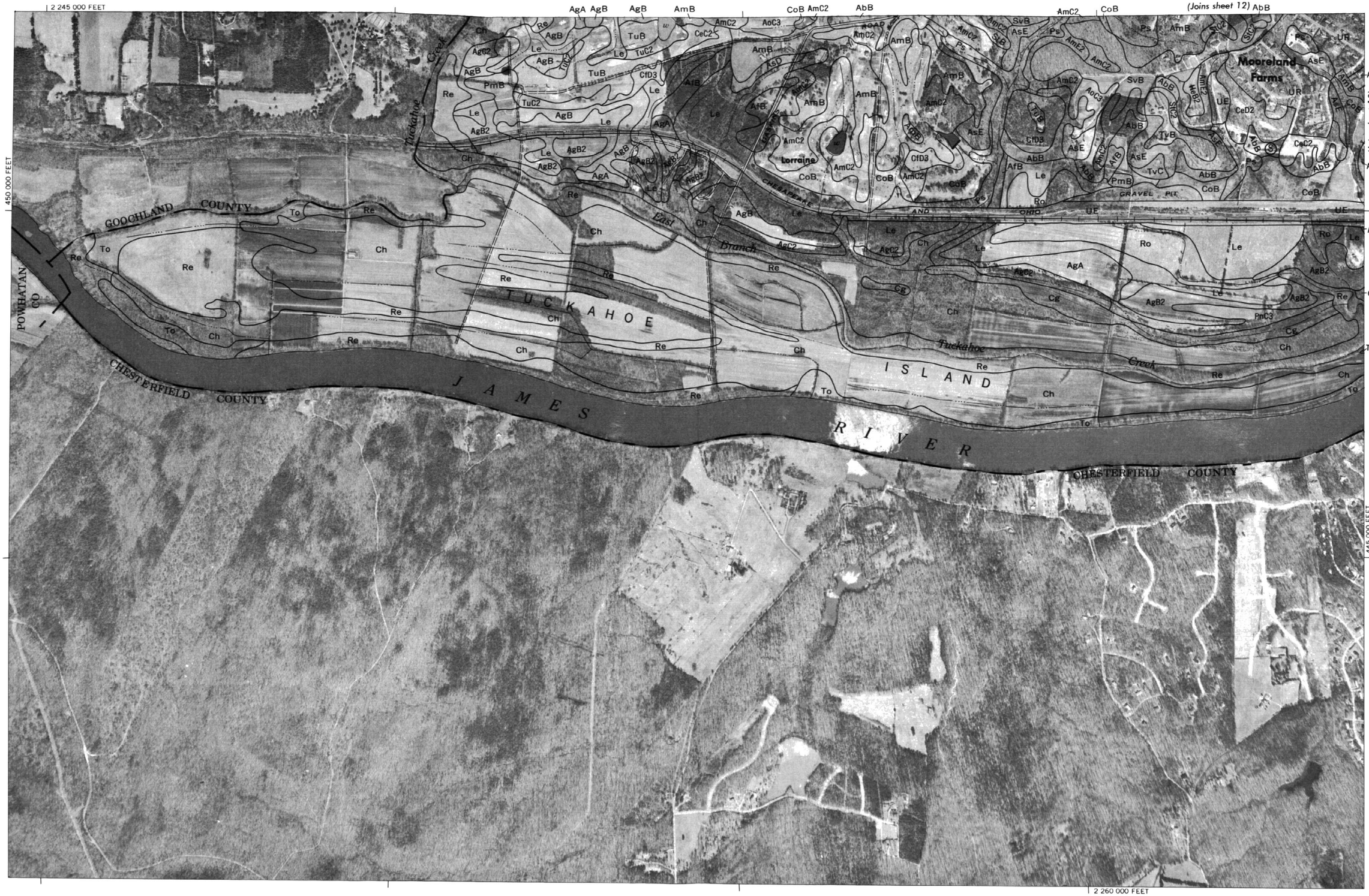
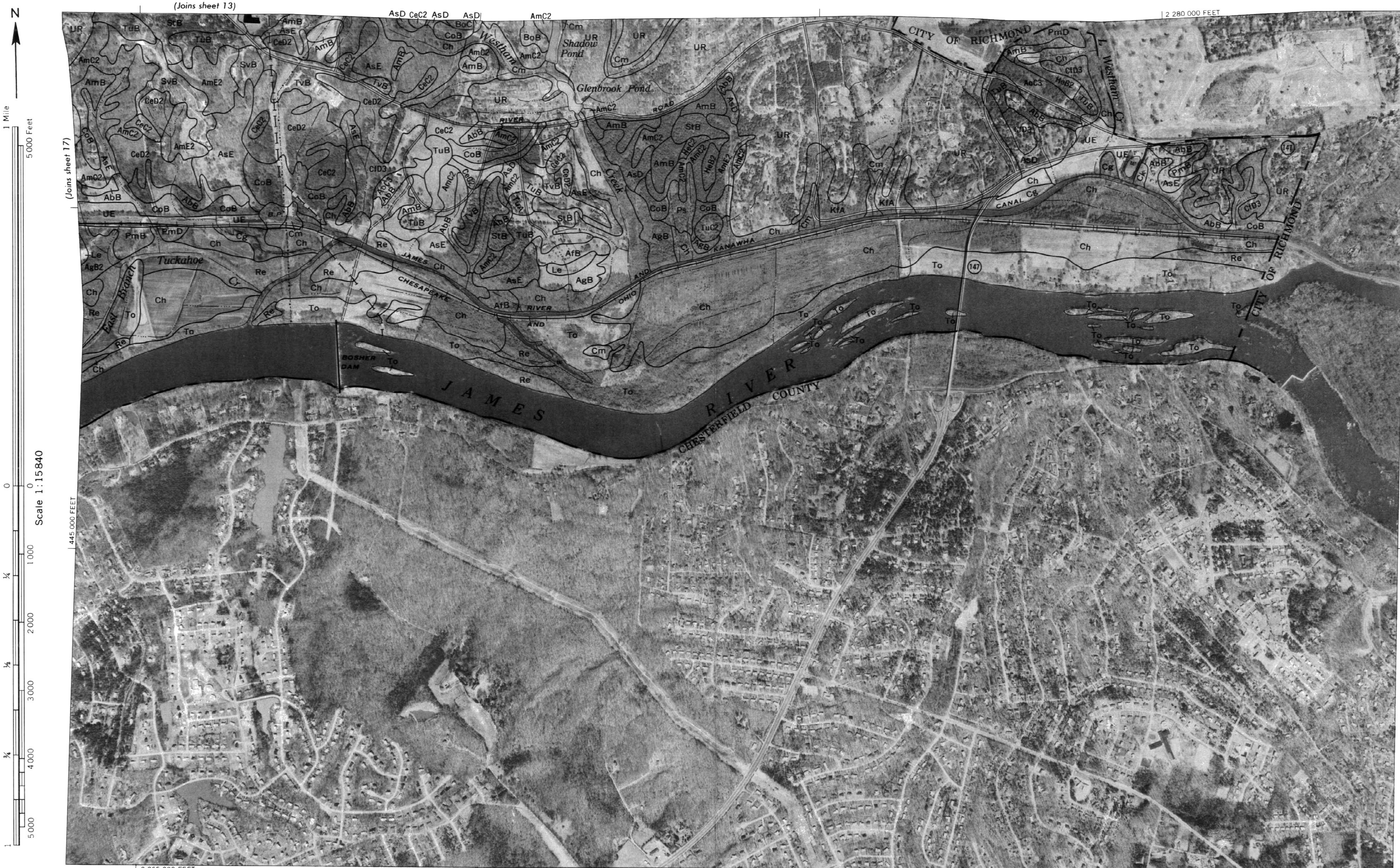
HENRICO COUNTY, VIRGINIA NO. 17



HENRICO COUNTY, VIRGINIA — SHEET NUMBER 18



HENRICO COUNTY, VIRGINIA NO. 18

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 19

N

1 Mile

5000 Feet

Scale 1:15840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000 FEET

2 340 000 FEET

445 000 FEET

450 000 FEET

2 325 000 FEET

(Joins sheet 16)

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 23)

Mayfair Place

Heckler Village

Windsor Ridge

Glen Echo Sch

Fairfield Jr High Sch

Fairmount Church

New Bridge Church

St Johns Church

Highland Springs High School

HIGHLAND SPRINGS

CREIGHTON ROAD

LABURNUM AVENUE

SOUTH AVENUE

GRAVEL PIT

DUMP

EAST END CEM

64

HENRICO COUNTY, VIRGINIA NO. 20

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 21

2 345 000 FEET

450 000 FEET

2 362 000 FEET

443 000 FEET

441 000 FEET

2 367 000 FEET

(Joins lower right)

(Joins sheet 25)

2000 AND 5000-FOOT GRID TICKS

(Joins sheet 20)

(Joins sheet 24)

2 360 000 FEET

445 000 FEET

(Joins inset)

Chickahominy River

HANOVER COUNTY

NEW KENT COUNTY

HIGHLAND SPRINGS

Oak Hall Church

GRAPEVINE ROAD

GRAVEL PIT

21

N

1 Mile

5,000 Feet

Scale 1:15840

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 22

N

1 Mile — 0 — ¼ — ½ — ¾ — 1

5000 Feet — 0 — 1000 — 2000 — 3000 — 4000 — 5000

Scale 1:15840

HENRICO COUNTY, VIRGINIA NO. 22

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 23

2 325 000 FEET

440 000 FEET

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 27)

2 340 000 FEET

430 000 FEET

N

Scale 1:15840

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

EAST END CEM

GRAVEL PIT

water

DUMP

CITY OF RICHMOND

Gillie

SOUTHERN

Oakwood Cem

Lawndale Farms

St James Church

Sanburne Park

Virginia Heights

Gilbert Gardens

MONTROSE HEIGHTS

Montrose Elem School

Robinwood

Lewis Gardens

SANDSTON

RICHMOND MUNICIPAL AIRPORT

CHARLES CITY ROAD

BARRYTOWN ROAD

LABURNUM AVENUE

PLANK ROAD

HENRICO COUNTY, VIRGINIA NO. 24

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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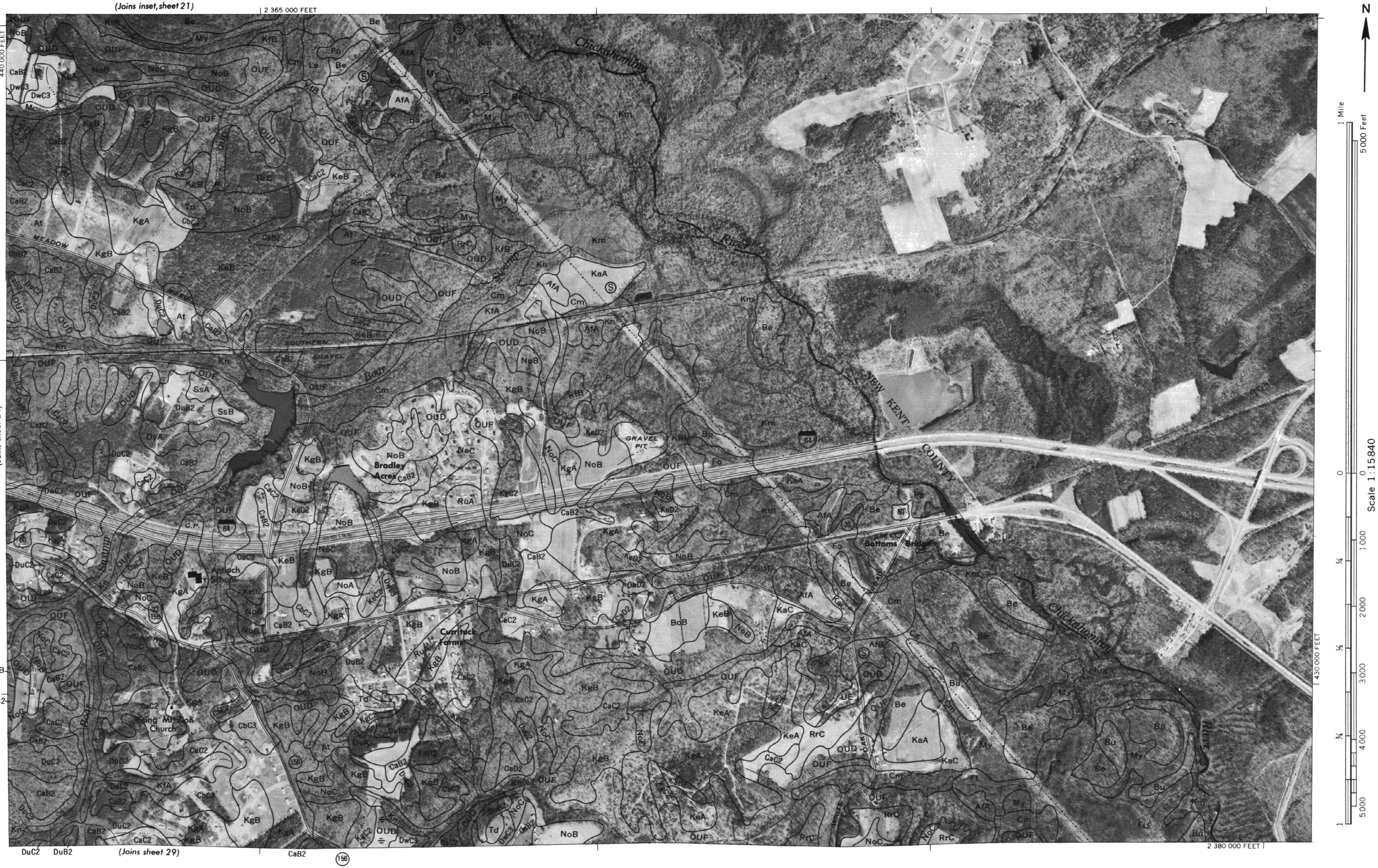

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 25

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 26

N

Scale 1:15840

1 Mile — 5 000 Feet — 0 — 1 000 — 2 000 — 3 000 — 4 000 — 5 000 — 1/4 — 1/2 — 3/4 — 1

HENRICO COUNTY, VIRGINIA NO. 26

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 27

HENRICO COUNTY, VIRGINIA NO. 28

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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N

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Virginia Polytechnic Institute and State University
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 29

HENRICO COUNTY, VIRGINIA NO. 30

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 31

2 325 000 FEET

415 000 FEET

(Joins sheet 27)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 35)

2 340 000 FEET

405 000 FEET

N

1 Mile

5000 Feet

Scale 1:15840

1 0 5000

¼ 1000

½ 2000

¾ 3000

¾ 4000

0 0

N

Scale 1:15840

1 Mile 0 5000 Feet

(Joins sheet 28) (Joins sheet 31) (Joins sheet 36) (Joins sheet 33)

2 360 000 FEET 415 000 FEET 405 000 FEET 2 345 000 FEET

HENRICO COUNTY, VIRGINIA NO. 32

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 33

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 34

N

1 Mile

5000 Feet

Scale 1:15840

HENRICO COUNTY, VIRGINIA NO. 34

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 35

(Joins sheet 34)

(Joins sheet 31)

(Joins sheet 36)

(Joins sheet 38)

2 325 000 FEET

2 340 000 FEET

400 000 FEET

395 000 FEET

1 Mile

5000 Feet

Scale 1:15840

HENRICO COUNTY, VIRGINIA — SHEET NUMBER 36

N

1 Mile
5 000 Feet
Scale 1:15 840
0 — ¼ — ½ — ¾ — 1
0 — 1000 — 2000 — 3000 — 4000 — 5000

HENRICO COUNTY, VIRGINIA NO. 36

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

HENRICO COUNTY, VIRGINIA NO. 37

N

1 Mile 5000 Feet

0 0 1:15840

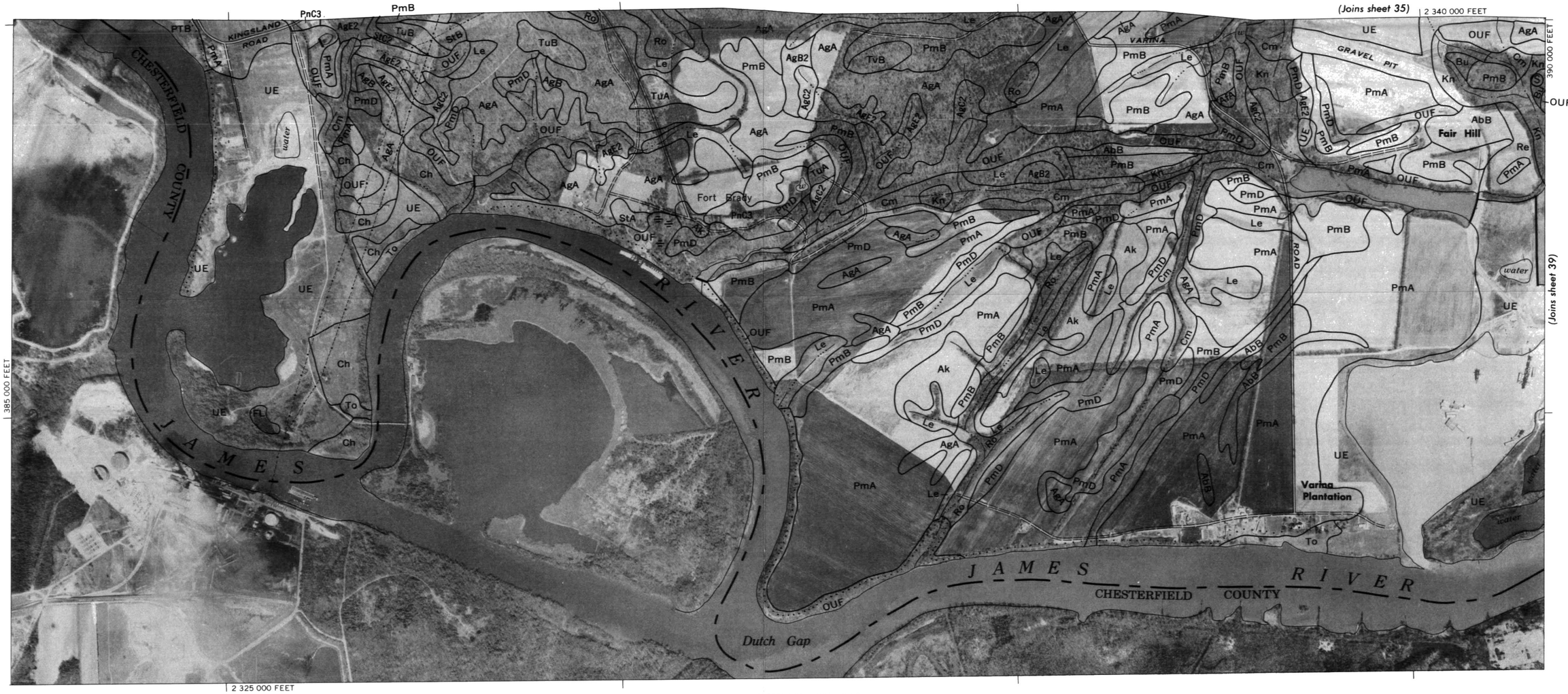
Scale 1:15840

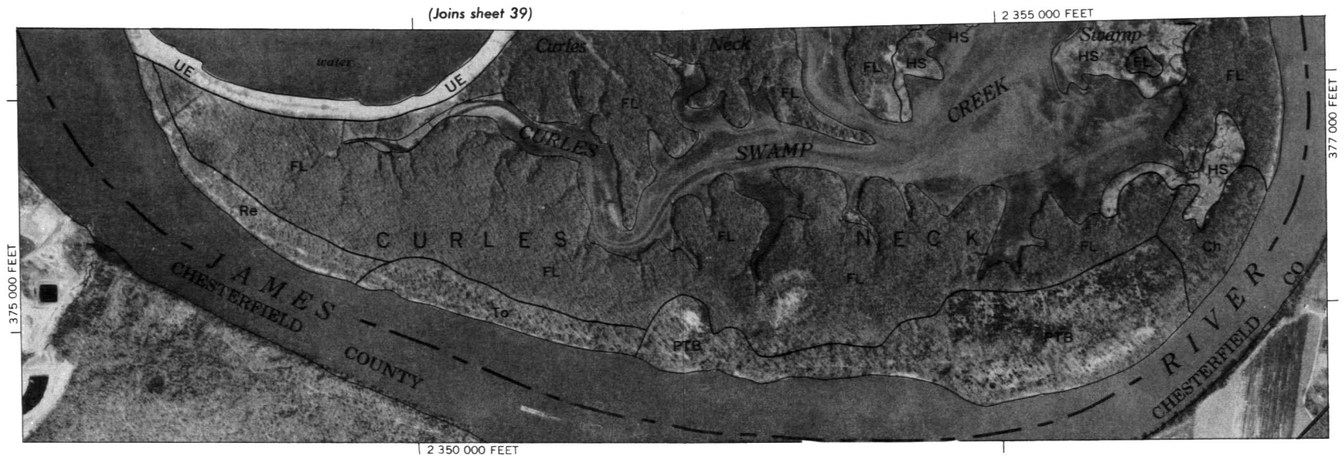
1/4 1000 2000

1/2 3000

3/4 4000

1 5000





HENRICO COUNTY, VIRGINIA NO. 38

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Virginia coordinate system, south zone.

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HENRICO COUNTY, VIRGINIA NO. 39

5
156

39

N

1 Mile
5000 Feet

Scale 1:15840

HENRICO COUNTY, VIRGINIA

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

- Buildings
- School
- Church
- Mine and quarry
- Gravel pit
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Forest fire or lookout station
- Windmill
- Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified
- Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

- Spring
- Marsh or swamp
- Wet spot
- Drainage end or alluvial fan

RELIEF

Escarpments

- Bedrock
- Other

- Short steep slope
- Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Soil sample site
- Area of Atlee soil, disturbed, 2 acres
- Area of Angie soil, concretionary subsoil variant, 2 acres
- Area of Udorthents, loamy, 2 acres
- Borrow pit (B.P.)